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04 January 2010

Version of attached file:

Published Version

Peer-review status of attached file:

Peer-reviewed

Citation for published item:

P., Sillitoe (1998) 'The development of indigenous knowledge : a new applied anthropology.', *Current anthropology*, 39 (2). pp. 223-252.

Further information on publisher's website:

<http://dx.doi.org/10.1086/204722>

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The Development of Indigenous Knowledge

A New Applied Anthropology¹

by Paul Sillitoe

The widespread adoption of bottom-up participation as opposed to top-down modernisation approaches has opened up challenging opportunities for anthropology in development. The new focus on indigenous knowledge augurs the next revolution in anthropological method, informants becoming collaborators and their communities participating user-groups, and touches upon such contemporary issues as the crisis of representation, ethnography's status with regard to intellectual property rights, and interdisciplinary cooperation between natural and social scientists. Indigenous-knowledge studies are challenging not only because of difficulties in cross-cultural communication and understanding but also because of their inevitable political dimensions. Contributing to development which intervenes in people's lives, these studies engage with them in novel ways.

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1. I acknowledge lively discussions with Peter Dixon, Piers Blaikie, Kate Brown, Lisa Tang, and Louise Shaxon and with the participants in an Overseas Development Administration Workshop on socioeconomic methodologies in renewable natural resources research (Farrington 1996) and in the Edinburgh University Anthropology Department's demicentenary conference "Boundaries and Identities," at which I presented parts of this paper.

A revolution is occurring in the pursuit of ethnography as the development world changes its focus from top-down intervention to a grassroots participatory perspective. The time has come for anthropology, with growing demands for its skills and insights in development, to consolidate its place, fostering the potential of the new relationship and building on its maligned applied tradition (Haile 1996, Rew 1992). The focus of the revolution is the appearance, within the broad context of the recent participatory approach to development (Chambers, Pacey, and Thrupp 1989, Burkey 1994, Farrington and Martin 1988), of a new specialism called among other things "indigenous knowledge" (Gladwin 1989, McCorkle 1989, Warren 1991, Warren, Slikkerveer, and Titiola 1989).² Any future applied anthropology is going to have to take account of these burgeoning enquiries.

It is now recognised that research in less-developed countries is not just a question of coming up with technological fixes to others' problems, passing along scientifically validated information for them to adopt. It is increasingly acknowledged beyond anthropology that other people have their own effective "science" and resource use practices and that to assist them we need to understand something about their knowledge and management systems (Atte 1992, Barrow 1992, Morrison, Geraghty, and Crowl 1994). A review of natural-resources projects funded by the U.K. Government's Department for International Development over the past decade reveals the growth of interest in local knowledge (fig. 1),³ although with only 1.1% of all projects featuring any such component there is considerable scope for its further incorporation if its worth can be convincingly established (Blaikie et al. 1996). This review picks up on the anthropologically self-evident point that effective development assistance benefits from some understanding of local knowledge and practices, urging anthropology to become more fully engaged in advancing such understanding. It summarises current interests in the field, draws attention to some methodological and other problems, and points to some possible future trends, citing for ethnographic illustration various swidden and allied cultivation regimes (Dove 1983, Warner 1991).

The difference between indigenous-knowledge re-

2. All manner of other terms are to be found in the literature for indigenous knowledge, among them rural people's knowledge, indigenous technical knowledge, traditional environmental knowledge, local knowledge, and indigenous agricultural knowledge. I use "indigenous knowledge" here as the term of widest currency in contemporary development discourse. Another paper could be written on the various meanings with which writers invest them. It is difficult to draw lines between indigenous knowledge, local knowledge, popular knowledge, folk knowledge, and so on. Even the word "indigenous" itself is fraught with obscurity; some writers imply that it applies only to non-Western knowledge, prompting others to query the status of "non-scientific" Western beliefs. These differences have a contentious political edge, with connotations of superiority and inferiority. But the absence of any consensus over terms intimates the flux that characterises this fast-moving and exciting field in development practice.

3. I am grateful to my colleague Peter Dixon for assistance with these data.

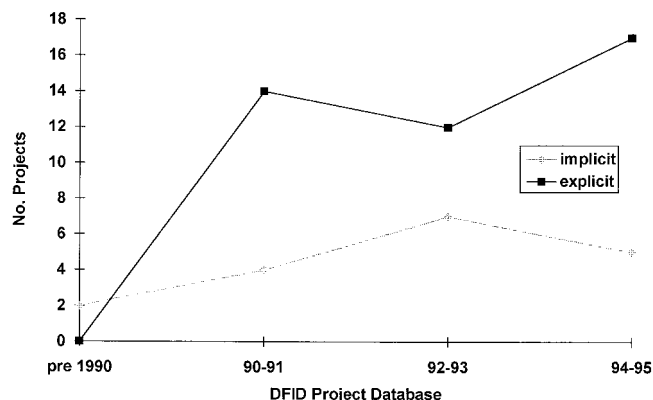


Fig. 1. *Indigenous knowledge as a component of Department of International Development projects (n = 4,500).*

search and anthropology is one of emphasis. It is less an intellectual pursuit than an applied one, its objective being to introduce a locally informed perspective into development—to promote an appreciation of indigenous power structures and know-how. In some regards, it is the introduction into development—some would argue long overdue—of a more explicit anthropological perspective. Anthropology needs to pay attention to this task or other disciplines will supplant it; already agricultural economists and human geographers, even foresters and plant pathologists, are stealing our disciplinary clothes. This is unfortunate for anthropology and development alike. The considerable problems encountered in trying to understand something about others' sociocultural traditions are not to be glossed over; misrepresenting them will lead to disillusionment. The current debate over whether it is justifiable to talk about indigenous knowledge illustrates the need for an anthropological contribution in that it ultimately questions the discipline's reason for existence (Agrawal 1995a, b; Sillitoe n.d.).

There are two strands to the evolution of the indigenous-knowledge perspective which have remained largely independent, one academic and the other development-focused (Howes 1980, Bell 1979). In academia the study of these issues over the past four or five decades occurs in two broad areas: ethnoscience and human ecology. In development it has emerged over the past decade or two, also from two broad approaches: farming systems and participatory development. This strand has depended crucially on a recent sea change in the paradigms that structure conceptions of development. The dominant ones until a decade or so ago were modernisation, the classic transfer-of-technology model associated with the political right, and dependency, the marxist-informed model associated with the political left (Hobart 1993). Indigenous knowledge was side-lined by both. The new, more grassroots-focused paradigms that have recently emerged to challenge these top-down perspectives are the market-liberal, which promotes market forces and decries state intervention, and the

neopopulist, which advocates participation and empowerment (Biot et al. 1995). They mirror the same political divide, but both give more credence to local perspectives. These paradigms are not mutually exclusive, often being conflated in policy and projects; technological and sociopolitical issues are inextricably intertwined.

Indigenous-knowledge research sets out explicitly to make connections between local people's understandings and practices and those of outside researchers and development workers, notably in the natural-resources and health sectors (Rhoades 1984, Brokensha, Warren, and Werner 1980, Richards 1985, Warren and Cashman 1988, Wamalwa 1989), seeking to achieve a sympathetic and in-depth appreciation of their experience and objectives and to link them to scientific technology. It aims to contribute in the long term to positive change, promoting culturally appropriate and environmentally sustainable adaptations acceptable to people as increasingly they exploit their resources commercially. Its intellectual stance is difficult to define, although by and large it has affinities to ecologically informed ethnography. It lacks theoretical or methodological coherence and is caught in a battle of perspectives (Long and Long 1992, Apffel-Marglin and Marglin 1990) as practitioners argue over right versus left, natural versus social science, hard versus soft systems, and so on.

The philosophy underlying indigenous-knowledge research is unexceptionable (Warren 1991, Warren, Slikkerveer, and Titilola 1989). That an understanding and appreciation of local ideas and practices will further development work is patent to any anthropologist. A classic illustration of how attention to them has promoted change in attitudes and perceptions of problems and priorities concerns shifting cultivation (Warner 1991, Dove 1981). Research has transformed the stereotype of feckless rain-forest-destroying peasants in need of modernisation to greater respect for local land managers, whose practices have undergone rehabilitation in some development circles as environmentally sustainable and locally appropriate (Fujisaka 1986). This has been viewed as explaining why they have proved surprisingly resistant to change and are esteemed by those who practice them (Sanchez 1976, Brookfield and Padoch 1994, Redford and Padoch 1992). It is increasingly recognised that development initiatives that pay attention to local perceptions and ways are more likely to be relevant to people's needs and to generate sustainable interventions. In Nepal, for example, where shifting cultivation ceased this century as population increased (Macfarlane 1976), attention to farmers' knowledge has revealed unrecognised constraints to production which appropriately targeted research may help ameliorate (Thapa 1994, Thapa, Sinclair, and Walker 1995, Rusten and Gold 1991). Conventional criteria for selecting agroforestry germplasm—according to tree survival rate, growth rate, foliage production, and so on—proved misplaced for Nepalis, for whom fodder tree crown architecture is a significant consideration because it influences crop yields, and selection of improved crop cultivars under full sunlight on agricultural research

stations consequently led to low rates of adoption because farmers wanted shade-tolerant plants.

While it is increasingly acknowledged as sound sense that people are more likely to respond positively if technical assistance based on our scientific approach is presented sympathetically with regard for their knowledge, this is a position that must be comprehensively validated if it is to be widely accepted (Mettrick 1993, Sharland 1989). The idea that shifting cultivation is environmentally destructive persists. In Cameroon this attitude has recently spawned a project to reverse the deforestation caused by slash-and-burn agriculture, although in the opinion of local people their farming system is sustainable (Grimble and Wellard 1996). They maintain that the project, mandated to establish plantations of valuable timber species on fallowed land, is causing degradation. The introduced species, they argue, are of little use; the manipulated habitat is less diverse than naturally regenerating secondary forest, not suitable for supplying game or non-timber products. They value secondary successions above forest as easier to reclear and bring under cultivation—a significant consideration where labour is in short supply and people knowingly trade off fertility losses against savings in time. Ignoring local needs and opinion is leading to tension and resistance and the likely collapse of the expensively imposed interventions when the project withdraws. Lack of respect for others' ways leads to offensive interference in their lives.

Local Perspectives and Scientific Research

The notion of technology transfer remains, now not as a top-down imposition but as a search for jointly negotiated advances. Participatory approaches seek a more systematic accommodation of indigenous knowledge in research on technological interventions (Schafer 1989). This is no straightforward endeavour involving the import of tried and tested approaches from anthropology such as the ethnographic method, sample surveys, case histories, etc. (Ellen 1984; Peltó and Peltó 1978; Werner and Schoepfle 1987a, b). It requires the formulation of research strategies that meet the demands of development—cost-effective, time-effective, generating appropriate insights, readily intelligible to non-experts, etc—while not compromising anthropological expectations (Tripp 1985).

The conundrums faced in promoting participation in research and development are manifold. The assumption is that our scientific tradition has something to contribute to the development process and that indigenous knowledge needs to be conveyed to scientists in such a way that they can appreciate its relevance (Warren 1989). This contrasts with the extreme empowerment view, which comes close to advocating that the poor should be left to their own devices—that allowed access to the technological alternatives on offer they will experiment and sort out their own problems (Chambers, Pacey, and Thrupp 1989, Haverkort et al.

1991, Scoones and Thompson 1994, Burkey 1994). There may be some truth to this radical perspective in some places and at some times. Anthropology has contributed to this critical appraisal of development goals, having long posed thought-provoking and sometimes awkward questions about what development means—pointing out that it is not a universal ideology. But the critiques are contradictory. They assume that aspects of scientific technology may remain in demand and that poor people wish access to technology and are aware of the alternatives available. A role for scientific research and technology apparently remains; the debate is over relating it more effectively to people's needs.

The problem is how people can be expected to participate when they do not know, scientifically speaking, what the alternatives are. Poor farmers given unrestricted access to scientific technology would likely choose industrial fertilisers, biocides, and machinery such as rotivators, tractors, and so on—inputs that reduce labour and increase marketable yields. These will be perceived as modern developments and markers of success, whereas they may be inappropriate and unsustainable given environmental and social constraints. Socioeconomic impediments, notably financial constraints and risk-aversion strategies, may put many if not all of these desirable innovations out of reach and deter any experimentation. Bush-fallow farmers cultivating on the Brazilian *cerrado* adjacent to rapidly growing towns frequently find their agricultural regime under stress, with soil fertility in a downward spiral (Watters 1971, Sombroek 1979, Le Thanh Nghiep 1986), and commonly seek inorganic fertilisers to reverse their declining yields. But it is uneconomic to apply the amounts required (unless food is so scarce that prices are extremely high, which in these poor communities will mean that food aid is likely to be on the agenda to prevent famine) and, furthermore, will likely result in serious pollution (eutrophication of lakes, nitrification of water supplies, etc.). The farmers, wanting a quick solution to their problems, are turning to unsustainable technology. Is it proper to leave them to be taught by the market, assuming that they will eventually recognise the ineffectiveness of their actions? Should informed outsiders keep quiet or offer advice, and if the latter how can they avoid adopting a top-down role? If scientific expertise is to be brought to bear on these pioneer farmers' problems, it demands considerable diplomacy. It is necessary to consider what other alternatives are available and how they may appropriately be researched (Sanchez and Salinas 1981; Montgomery 1988; Posey 1983a, 1984).

While one way forward may be to acquire a sympathetic understanding of the farmers' position through anthropological research and then seek technological alternatives that better fit their situation and aspirations (de Queiroz and Norton 1992, Hecht 1989), conflicting expectations nonetheless remain a problem. Agricultural development in the Papua New Guinea highlands has largely focused on cash crops, notably coffee, in an attempt to bring shifting cultivators into

the market and “modernise” them. Highlanders want to possess various manufactured goods from processed foods to cotton clothing and radios to vehicles and are keen to cultivate crops that will bring them cash and purchasing power, whereas chronic socioeconomic problems (breakdown in law and order, political corruption and administrative inefficiency, inadequate infrastructure and weak access to markets, etc.) make such commercial developments difficult and expensive.⁴ It would probably prove more effective to divert resources to improving subsistence agriculture, but this effort might face motivational problems. First, it is not desirable cash-crop development. Secondly, what highlanders think will improve yields may again not suit their circumstances. They express an interest, like *cerrado* farmers, in fertiliser “soil medicines,” and what little research has been conducted on subsistence crop nutrition has focused on fertiliser trials and recommendations (Floyd et al. 1988). But these are inappropriate; farmers lack the resources to take advantage of them.⁵ It would make more sense to assess indigenous practices regarding soils and fertility management such as the local grass fallow system and options for increasing its efficacy by breeding more efficient fallow species (Sillitoe 1996). A serious potential problem with a participatory search for sustainable technological solutions is that it may appear to limit people’s options to what they perceive as second-best. If farmers are unable to comprehend the economic and environmental constraints on their choices, they may think that they are being deprived of high-tech solutions and fobbed off with cheap alternatives. This is a possible danger if indigenous-knowledge and farmer-participatory research is not effectively linked with large-scale natural-resources research. The result will likely be lack of interest and difficulty in convincing people that there are alternatives worth trying out.

Science, Technology, and Indigenous Knowledge: Some Complementarities

The perspective of natural science has proved successful in promoting the kinds of interventions that development demands (Reyna 1994). It derives from European society, although it is being widely practised and advanced by specialists around the world. It is largely foreign to other local cultural traditions, which customarily have few if any ideas equivalent to molecules, phase functions, and so on. But their practices and

knowledge relate, we assume, to the same natural world “out there,” albeit expressed in quite different idioms revealing concerns for somewhat different issues. The contention is that the two perspectives taken together produce a more rounded understanding of natural and cultural environments and sustainable development potentials (Quiroz 1996) relating to both people’s thoughts about their practices as agents and our perceptions as observers. The implication of considering indigenous and scientific perspectives side by side is *not* that we can translate another culture’s conceptions into scientific discourse or necessarily that we should test them according to its canons—both are relative—or that scientists need to revise their working suppositions regarding objectivity, positivism, reductionism, and so on, to accommodate others’ views (Reyna 1994). But a straightforward account of other people’s environmental lore and practices that intervene in nature’s arrangements cannot adequately address development issues as we perceive them. These have implications which we cannot fully explore from the perspective of other cultural traditions so far as we manage to apprehend them. For example, we can report New Guinea highlander horticultural practices and their comments about the soil and its behaviour under cultivation, about “grease” levels, and so on, but if we ask people what it is about their soils and crops that allows them to farm this way, they are likely to respond “They just do.” They may comment further that they are following their forefathers’ ways, time and tradition having proved their practices effective, and they may describe some changes observed in soil conditions under cultivation, but no thoroughgoing explanation equivalent to that of scientific theory will be forthcoming.

The interpretation and assessment of indigenous knowledge alongside scientific criteria is a contentious issue related to emerging “hybrid” studies (Murdoch and Clark 1994, Latour 1993, Papastergiadis 1995, Forsyth 1996), an aspect of what others have called the “knowledge interface” (Blaikie et al. 1996, Jiggins 1986). Although evaluation may be dubious—science having only a partial understanding of the phenomena to which indigenous knowledge relates against which to assess it (Fairhead n.d.)—it is conceivable, according to scientific canons, that other people may “get it wrong.” It is not only the West that is susceptible to “myths” about the world. While it is conceded that others’ statements about nature might express different ideas, serving as cultural metaphors or commentaries on other issues, this does not rule out the possibility of error. Some New Guinea highlanders, for example, burn pieces of old net bag to stop rain and squash sappy plants to end droughts. In meteorological terms neither practice has any effect on the weather. We may proceed as anthropologists to speculate on wider symbolic associations, but from a scientist’s perspective, people who believe these practices influence the weather are wrong. Furthermore, symbolic interpretations are hard to evaluate even when set skillfully in sociocultural context; as current postmodern criticism testifies, they are notori-

4. Also, coffee, a long-term perennial crop, is socially problematic, giving rise to tensions over land tenure by fixing what traditionally, under short-term crops, are flexibly interpreted land rights. These problems have been particularly sharp where expatriate-established plantations have passed back into local ownership; people dispute the sharing of work and profits, finding it difficult to cooperate in these ventures under their society’s individualistic and egalitarian ethos.

5. Furthermore, the nutrient fixation capacities of the soils they cultivate require large applications to achieve growth responses.

ously difficult to substantiate beyond the enquirer's imagination. The scientific-ethnographic partnership offers an opportunity to compare indigenous statements and explanations against scientifically measurable data, as opposed to dealing only with sociocultural "facts" the subjective status or otherwise of which has contemporary anthropology experiencing acute epistemological doubt (Jackson 1989). We can, for instance, compare people's comments—spoken, gestural, symbolic, or other—about the impact of shifting cultivation with observations of their environment.

While indigenous knowledge often facilitates people's skillful management of their resources, we need to guard against any romantic tendency to idealise it. It may be inadequate, especially in situations of rapid change—for example, when in response to population growth shifting-cultivation fallow intervals are reduced until they fail to restore soil fertility and lead to long-term land degradation—or natural or human-induced disaster such as volcanic eruptions or political upheavals which may cause flight to an area where the knowledge is less appropriate besides exacerbating any population problems. The localised relevance of indigenous knowledge is a significant barrier to its incorporation into the development process. Africa offers several examples of the inadequacies of indigenous knowledge in the face of contemporary problems (McCall 1988, Ostberg 1995). In southern Malawi, where continuous cropping has displaced shifting cultivation with population growth, parasitic *Striga* (witchweed) has become a serious problem, markedly reducing crop yields and even causing complete failure. Alternative fertility management strategies featuring manure or fertilisers are uncommon, and nutrient deficiencies contribute to severe parasitic weed infestations. While aware of infestation symptoms, even those evident before weed emergence, farmers are apparently unclear about certain aspects of witchweed botany that are critical to its control—for example, that it is parasitic on crop roots or that it seasonally produces large numbers of dustlike seeds that can remain viable for decades—and these gaps in their knowledge inhibit its arrest (Riches et al. 1993). Some interpret indigenous-knowledge enquiry narrowly as identifying such gaps in others' understanding as constraints on production and targeting scientific research and extension to fill them.

It is, however, probable that scientific assessment of indigenous knowledge and practices will vindicate them (Gliessman 1981). The heretical idea is gaining currency that others may have something to teach us (Fairhead n.d., Rajasekaran, Warren, and Babu 1991). The cross-cultural study of their knowledge may advance our scientific understanding of natural processes by challenging our concepts and models. According to Nepali agro-ecological lore, for examples, tree leaves of different size, texture, density, and inclination cause leaf-droplet splash erosion to different extents. Until recently scientific opinion held that erosion was independent of leaf morphology (because of water's surface-tension properties), but it is now acknowledged that leaf

size and texture may affect erosive potential—a finding with implications beyond Nepal (Thapa 1994, Thapa, Sinclair, and Walker 1995). The contrasting of indigenous with scientific knowledge should further rather than inhibit the empowerment of poor people through respect for their experience and management practices (Fairhead n.d., Hall 1981, Thrupp 1989b). A commitment to putting their views on the development agenda presupposes that their cultural traditions not only are valid but also may contain valuable intelligence unknown to us and at the very least represent a perspective that we need to accommodate sympathetically. Furthermore, without genuine respect for their accomplishments, talk of local participation amounts to little more than politically correct rhetoric.

There are dangers inherent in comparing and contrasting scientific explanations with other people's understandings of their activities, notably the threat of ethnocentrism—imputing inappropriate concerns and predetermining problems. Perhaps one of anthropology's main contributions to development is to challenge ethnocentrism and oblige us to come to terms with it. It is not easy to achieve a sympathetic awareness of others' views, but anthropology helps promote an open and flexible attitude of mind more likely to appreciate alternatives. By exposing us to a range of ethnographic evidence it makes us more inclined to see, hear, and appreciate what people are doing, perhaps against our expectations. But ethnocentrism remains common. The lack of respect for others' knowledge traditions manifested by many Western scientists, underpinned by the assumption that technological superiority implies answers to all difficulties, is a considerable barrier to development. While it is beyond doubt that science has contributed to considerable technical advances over the past three centuries or so, other people have impressive technological arrangements too. It is not easy to admit that their ways of managing resources are sometimes more appropriate and environmentally sustainable and that development should be a two-way process. Alarming rates of environmental pollution, the squandering of resources, feelings of social alienation, etc., underline the limitations of applied science. Interventions may start from false premises if science alone informs them. Regarding soil erosion in the Papua New Guinea highlands, the combination of high and sometimes prolonged rainfall and precipitous terrain suggests a region particularly at risk (Humphreys 1984). People regularly cultivate steep slopes, exposing vulnerable soil. Yet attitudes seem strangely off-hand regarding the dangers, and there are few apparent conservation measures. Whatever initial appearances, however, soil erosion data belie carelessness (Sillitoe 1996). The soils are stable, the crops cultivated afford good cover, and few intensely erosive rainfalls occur. Conservation measures beyond prudent cultivation practices informed by generations of experience are unnecessary (Paglau 1982, Wood and Humphreys 1982, Bleeker 1983, Burnett 1963, Hausler 1995). Clearly, if technical assistance is not coupled with the cultural awareness

which an anthropological background promotes, it can all too easily become technical arrogance that may lead to misperceptions of problems and inappropriate research. The bottom line is perhaps that all researchers, whatever their technical background, should ideally have some awareness of anthropological issues to promote an awareness of alterity and its implications (Sillitoe 1994).

Interpreting Indigenous Knowledge for Development: Problems at the Interface

The pitfalls of ethnocentrism are evident in some indigenous-knowledge research; some scientists behave as if it were possible to pluck information relating to their specialisms out of cultural context and treat it as independent technical facts. We need to establish that it is dangerous to do this and demonstrate the importance of understanding environmental interactions and development opportunities within their sociocultural contexts. Anthropology has long known that it is impossible to predict which cultural domains will be linked with which others and that it is important to maintain a broad view. All manner of other cultural activities may influence production activities, from social arrangements to religious observances. The selection of swidden sites in the New Guinea highlands illustrates the social embeddedness of local knowledge and practices. A technically oriented perspective would endeavor to understand the process according to physical factors such as slope, topography, vegetation, and so on, perhaps relating these to cultivation issues such as soil type, weed-proneness, erosion hazard, and so on. Other factors that may enter into a farmer's calculations include tenure rights, conditioned by current family relations—people wishing to be near certain relatives—and subject to disagreements. These considerations may extend to the site's nearness to the house, with its implications for transporting produce home. Other labour considerations include how easily the site can be enclosed to keep out foraging pigs; people prefer locations with physical barriers such as rivers, gullies, and rock faces that reduce the need for heavy fencing and ditching work. And the crops subsequently cultivated in gardens relate to gender ideology. The assignment of gender to plants, as belonging to either men or women, appears arcane and might even be dismissed as irrelevant, but it influences cultivation practices and has environmental implications. People maintain a sharp distinction between men's and women's cultural worlds; men fear women's believed capacity to poison and harm them, notably with menstrual blood. They hedge the cultivation of taro around with taboos to protect it from these deleterious influences, cultivating it behind leafy screens to prevent those who have recently engaged in coitus from seeing the crop, and they have a series of spells which they mutter when planting it which esoterically encapsulate a range of knowledge pertaining to

this crop's cultivation (Sillitoe 1983). These beliefs and not just biophysical conditions such as the waterlogging that usually prevails in these gardens influence the crops they cultivate with taro. They talk of the soil as having "blood" before cultivation and "no blood" afterwards; likewise, the sick and weak are described as having "no blood." A sympathetic consideration of these idioms relating to human and crop health and fertility is central to appreciating some of their horticultural practices and to achieving an understanding of how they are managing their natural resources, and their implications for agro-ecological science, with regard to intercropping patterns, soil fertility, pest management, and so forth, are critical. This ethnographic vignette highlights the centrality of sociocultural context in understanding indigenous knowledge and the misinterpretations invited if it is treated as mere technical information (McCall 1995). Anthropological experience advocates viewing development problems in the round and not as isolated constraints to be overcome with technological adjustments. It is rare for production problems to be amenable to straightforward technical solutions. More often many factors contribute to the perceived constraint, comprising a complex natural and social system.

Concepts central to agricultural science may therefore not be entirely appropriate to understanding and documenting local practices and should not be allowed to determine research priorities. The category of "weeds," for example, may be inappropriate to shifting cultivation regimes (Altieri 1988). Plants other than crops may not be useless; aware that vegetation affords soil protection, farmers may manage both crops (frequently through intercropping) and weeds as ground cover against erosion. The manipulation of weedy regrowth may also feature prominently in their strategies for managing soil fertility. In parts of Africa people are attentive to uncultivated plants as constituting, not merely indicating, soil fertility and think of weeds as a fertility store to be managed (Fairhead n.d., Amanor 1991, Hailu and Runge-Metzger 1993, Ravnborg 1990). And in the New Guinea highlands they repeatedly cultivate some sites with minimal or no fallow breaks and no outside amendments without any catastrophic decline in productivity by manipulating weedy regrowth—incorporating it into mounds during recultivation as compost or ash (Sillitoe 1996). And, recognising non-crops as useful plants, farmers may husband them to an extent as the forerunners of the regrowth that will contribute to the maintenance of long-term site fertility—practices which relate to biodiversity issues, conservation, and so on. The semimanaged regrowth of weeds under milpa agriculture in Belize limits soil nutrient declines by accumulating large proportions of those available and preventing their loss by leaching; the steadily increasing numbers of weeds also make it uneconomic for farmers to continue, obliging them to abandon sites before overcultivation and fertility crashes (Lambert and Arnason 1989).

Even with an awareness of the pitfalls of ethnocen-

trism, it remains difficult to achieve a meaningful understanding of others' knowledge, let alone communicate it to others and make connections with their work. The problems that attend the interpretation and analysis of indigenous knowledge in terms understandable, accessible, and relevant to outsiders such as scientists, planners, and policy makers are formidable. We face not only the considerable task of demonstrating its importance but also that of sympathetically capturing the concepts expressed in local idioms and the import of the associated activities (Bain 1989, Barker 1977). It is not just the accommodation of a scientific perspective in this research that threatens distortion. Rather, we constrain understanding in reducing everything to words. People transfer much knowledge between generations by tradition learnt and communicated through practical experience and are not familiar with trying to express everything they know in words. Heirs to effective systems of natural-resource exploitation that have evolved over many generations of experimentation, local farmers may follow practices that have agro-ecological implications, sometimes apparently without any need of analytical discourse (Moore and Golledge 1976). Knowledge is passed on by informed experience and practical demonstration; more often shown than articulated, it is as much skill as concept. If requested to assess the soil at a particular location, New Guinea highlanders may inspect it and even handle it before passing judgement. If asked to justify their assessment they will in all likelihood look somewhat bewildered. They will probably suggest that you look at the soil, maybe even pass you a handful to feel, the implication being that you must be able to tell. If one is a farmer one just knows; one is not used to being asked what or how. Awareness of the soil is an accumulation of experiences of cultivating it and hearing many comments from others about it (Sikana 1993). The practices work, and this is sufficient for people. The pragmatic foundation of such knowledge presents problems (McGraw 1989). It is contingent and often local, not systematised and universal. This has contributed to the failure so far to develop an integrated theory relating to it; indeed, this may prove impossible, for it is difficult to conceive of a single paradigm covering all knowledge traditions worldwide. It is extremely difficult for outsiders to understand and to pass on what they learn, particularly within the limitations of a literate intellectual tradition. And employing not just scientific but foreign words and concepts further misconstrues whatever it is that we manage to comprehend about others' views and actions communicated piecemeal in everyday life.

Furthermore, as intimated above, people may carry knowledge and transfer it between generations using idioms alien to science, featuring symbols, myths, rites, and so on (van der Ploeg 1989). If one asks New Guinea highlanders about their attitudes to the rain forest and its destruction in establishing new swiddens, they are often puzzled, not being used to thinking in terms of forest management and conservation. But they have beliefs in demons that occupy the forest, which some-

times attack human beings, and they have protective rituals and spells that suggest something about their equivocal attitudes to forest exploitation and preservation (Sillitoe 1996). Some years ago, structuralists might have speculated that selected symbolic idioms, figurative imagery, and so on, could be interpreted as indigenous environmental theory, expressed as metaphors, binary oppositions, and such. But it is difficult to make such interpretations appear convincing today, and relating them to scientific understanding of natural-resources management is doubly difficult. (This is not, of course, to suggest that others' knowledge of their environments is expressed in traditions any more esoteric than the scientific one.) The understanding we achieve is inevitably contorted, given our unavoidable outsider perspective, but this should not inhibit us from making the effort; we have to accept the inevitable limitations of our research methods. Any translation of another culture is distorting; this development-oriented indigenous-knowledge work is no different to any other ethnographic enquiry in this respect. It differs in its struggle to combine different disciplinary perspectives in understanding and interpreting other cultures and their environments as the demands of development require. This distances it from any pretence of achieving an understanding of others as they understand themselves or, worse, better than they understand themselves.

Promoting Communication among Stakeholders

While people live rather than reflect on a great deal of their knowledge, development agencies wish to identify problems and turn to science and technology for a theory and a way forward. The incorporation of indigenous knowledge into the development process demands producing accounts that relate to this other research (Posey 1983*b*). We need to avoid the danger of taking the socio-cultural embeddedness issue too far and producing ethnographic accounts which will strike scientists as esoteric records which they are unable to relate to their work. There is a need to make the connections. The significance for natural-resources research of New Guinean or African farmers' descriptions of agro-ecological processes in terms of human sickness and reproductive capacity needs to be spelled out (Fairhead n.d., van Binsbergen 1988, Schoffeleers 1979). The relevance of associating human reproduction with crop breeding (both featuring the mixture of fluids in warm soft conditions, in women's wombs and rain-fed soil) or ripening crops that fail with menstruating women (both signifying infertility, the absence of viable seed) may not be immediately obvious (van den Breemer 1992, Gottlieb 1982), but these locutions may contain intelligence of interest when interpreted in more familiar terms and may prove central to successful extension work.

One of the central methodological issues of the indig-

enous-knowledge and participation debate is facilitating meaningful communication between scientists and local people to establish what research may have to offer, informing natural science with ethnographic findings and recognising the advantages of each (Campas 1991, Warren 1989). It is necessary to go beyond asserting that indigenous knowledge and ethnoscience are effective to demonstrating this convincingly to those in other, notably applied, disciplines (Fujisaka 1992). Until technicians take them seriously, the debate over local participation will have limited impact. But making indigenous knowledge accessible to other scientists and relevant to their research raises considerable methodological problems which should not be underestimated. We have to build on approaches that range from robust commonsense schemes—for example, Bentley's (1989, 1992) four classes of farmer knowledge according to axes of "importance" and "conspicuousness"—to those that draw on expert-systems computer technology—for example, Walker, Sinclair, and Thapa's (1995) formal representation of indigenous agroforestry knowledge and associated Agroforestry Knowledge Toolkit software package (Sinclair et al. 1995). The current explosion in database technology may facilitate the recording and recalling of ethnographic information and its cross-referencing to relevant development fields, making it readily available to specialists such as foresters, fisheries specialists, soil scientists, and so on. We need to avoid jargon-laden and obscure accounts while not overlooking the insights to be gained through often subtle anthropological arguments. There is currently no consensus about the best way forward.

It is necessary to abandon the assumption that we can record and document indigenous knowledge and pass it "up" to interested parties as technological packages are passed "down" to beneficiaries (McCall 1995). The methodology cannot be static or uniform and is subject to continual negotiation among stakeholders. Indigenous-knowledge systems are rarely if ever isolated from the rest of the world; people will incorporate and reinterpret aspects of Western knowledge and practice into their traditions as part of the ongoing process of globalisation. Indeed, while knowledge never stands still, development advocates contemplate accelerating its change—dramatically modifying indigenous-knowledge systems in the long run with a scientific perspective. The tenacity with which people hold onto their cultural traditions, even going to war to defend them, suggests that this is unlikely in the foreseeable future. The dynamism of indigenous knowledge not only increases the difficulties that we face in attempting to grasp it (Cox et al. 1995) but also compromises our attempts to represent it. We have to consider how it changes when it is taken from its local cultural context and enters into the discourse of scientists, political decision makers, and development workers. The lability of indigenous knowledge is reflected in the theoretical shift in anthropology from a structural to a processual perspective, although this move is proving extremely difficult to operationalise in ethnographic research. The

synchronic-versus-diachronic tensions remain. The indigenous-knowledge research component of a development project clearly cannot be accomplished overnight; the dynamic nature of development demands an iterative strategy that closely links research to ongoing indigenous-knowledge investigations.

The methodological issues are similar seen from the local side, focusing on the promotion of more effective participation in the identification and tackling of researchable constraints and partnership in decision making, planning, and implementation. Science does not stand still, either, being subject to constant challenge and revision, and is restricted to a relatively few specialists. Participation can be achieved only to the extent that awareness, knowledge, and sociopolitical barriers allow. A problematic assumption, as already seen, is that local people can frame their problems in a manner intelligible to scientists. The crux seen from the local side is informing people about the scope of scientific research and what it might offer them (Bebbington et al. 1993, Compton 1989a). There is already a shift of emphasis from the top-down delivery of agricultural extension messages prepared by outside experts, persuading and inducing people to adopt procedures that often appear alien and sometimes deprive them of control over their own activities, to consulting more and giving space to local ideas in the research-and-development process (Röling 1988, Rhoades and Booth 1982). A sympathetic appreciation of Central American peasant farmers' ideas has had positive effects on research across the interface between science and indigenous knowledge (Bentley 1989, 1992b). These farmers' use of the word "ice" for plant disease (because the effects of disease resemble cold burn) caused confusion at first, but when the idiom was understood extension agents were better prepared to discuss interventions. While the aim is to allow local populations to make informed decisions by telling them about alternatives and constraints, extension strategies such as the World Bank-favoured training-and-visit system have often fallen short of expectations because they have failed to bridge the distinct knowledge traditions involved.

A central problem with incorporating indigenous knowledge into development projects is the bridging of the gap between our scientifically founded technology and local awareness and practices (Compton 1989b, Jiggins 1986, Posey 1983b, Rhoades et al. 1982). If indigenous-knowledge research is to serve as a link between local people's perceptions and aspirations and scientific technocrats' research agendas (Sardan, Paquot, and Paquot 1991), we need to promote facilitatory methods that combine anthropological skills with technical and scientific knowledge. This is not to suggest that social anthropology has the answers to many of the intractable problems that characterise development, for nothing could be farther from the truth. Anthropology has no technical qualification for addressing less-developed countries' problems. Some awareness of science and technology is required to communicate with specialists; anthropological awareness is only a part of the

equation. One of the strengths of a facilitatory anthropological approach is that it not only fosters respect for others' ideas and views but also promotes discussion of problems with scientists using their language and theories. The idea of harnessing anthropology to technical knowledge to facilitate development puts the discipline where it should be, at the centre of the development process (Haile 1996). The success of facilitatory anthropological research will depend in considerable measure on the appropriateness of the options researched, considering the full panoply of sociopolitical and cultural constraints through dialogue with specialists in relevant fields and formulated as technical possibilities with local people, assuming that they will experiment with appropriate alternatives.

Interdisciplinary work will be central to methodological advances in this development research, combining the empathy of social scientists with the technical know-how of natural scientists to tailor interventions to local conditions (Mettrick 1993, Rhoades et al. 1982). The problems that attend interdisciplinary research are, however, legion; it regularly founders on the rocks of misunderstanding and the unwillingness of specialists to generalise and compromise. An integrated perspective implies a willingness to learn from one another; researchers need to allow all knowledge a place. It may be appropriate for someone to be responsible for conducting indigenous-knowledge research, but this does not mean that this component of the project should dominate. There must be a genuine reciprocal flow of ideas and information among all parties. Motivation will depend in considerable measure on commitment to consensus decision making and open debate.

The demands of indigenous-knowledge and participatory research require the establishment of partnerships founded on dialogue. These may feature either natural-resources scientists aware of the anthropological perspective or social scientists with some technological background. One possible way to build a genuinely interdisciplinary research team is to include personnel with multidisciplinary backgrounds, but this requires intellectual support; having no single disciplinary allegiance can result in isolation (one colleague accused me of not being a real anthropologist). The combination of the empathy of a social science with the technical know-how of a natural science will go some way toward better qualifying researchers to consult people and build on their practices in acceptable ways. The requirement of interdisciplinary work poses questions for ethnographers: Will teams of researchers be too invasive and disturbing to communities? Will the presence of outsider colleagues make it difficult to effect some move "inside" and hamper joining in others' lives?

Empowering Whom through Participation?

The earlier comments on the cultural embeddedness of knowledge warn us that this research is not socially neutral (Cashman 1991); dealing as it does with com-

plex natural and social systems, it intimately and unavoidably involves political issues (Bates 1988, Thrupp 1989a). Technical innovation, leading to development interventions, promotes social change and inevitably interferes with social arrangements. The ethical implications are enormous. There is a fine line between seeking to assist others in finding solutions to their problems, well-intentionedly informing planners, researchers, policy makers, politicians, and others of the possible implications and impacts of research and development strategies, and interfering unacceptably in their social and political arrangements. Perhaps drawing the line is a personal matter. Becoming involved in overt empowerment initiatives is problematic from an anthropological perspective because of its social-engineering implications (Nelson and Wright 1995). It clashes with the anthropological tenet of cultural relativism—not judging others' practices even if they offend our moral code. Direct involvement in empowerment initiatives seems an inappropriate role for foreign researchers, who as knowledge brokers should inform politicians and others about issues as they perceive them and leave the responsibility for policy decisions to them. They are there because it is thought that outside technical know-how has something to offer for tackling their problems, not to engage in politics. This culturally relative conviction should be central to the notion of participation—that the members of any society maintain so far as possible control over their own lives, according to their own cultural values, and do not have social "solutions" imposed on them by outsiders. Nevertheless, any research seeking to understand and facilitate development inevitably interferes to some extent. While any social analysis should be couched dispassionately, this is notoriously difficult not only because of the cultural values that inevitably inform our worldviews but also because of the political web in which we are all caught. The focus on indigenous knowledge obliges anthropologists to reappraise the contentious issue of relativism; contributing more centrally to development than previously, with the aim of assisting certain people, notably the very poor, over others, it is unavoidably intervening in their lives (Barnes and Bloor 1982).

The current liberal position, broadly speaking, is that wealthy nations recognise a global obligation to assist the very poor on the understanding that the countries they help are willing to receive such assistance. The implication is that this may influence social arrangements; furthering the interests of this one social group may threaten the positions of other, wealthier and more powerful members of society, who may resent this and try to obstruct development initiatives. There is consensus that a small proportion of taxes should go to this work, with no expectation of a trade return or political pay-off, although in reality funding agencies, as powerful stakeholders, have political objectives. The assumption is that taxpayers have the right to expect the assistance to reach the poor and not be subverted by the wealthy, some of whom are likely to be in government.

In this sense we are not neutral researchers but stakeholders too, trying to ensure that the poorest benefit. Once it is seen that we are inevitably involved, the way is open for accepting the proposal that development should involve negotiation among all parties. This negotiation applies not only to seeking some consensus over the way forward, how development should proceed, and whom it should aim to benefit but also to coming to some shared understanding of the issues at stake. These negotiations ideally should involve all stakeholders, although this may prove unrealisable given the perverse power plays that characterise development, the nature of bureaucracies, and so on. It is necessary to face up to the different aims of different parties both within and between societies and candidly acknowledge the political implications. Debate is needed to establish what different stakeholders' agendas are and the degree to which they can be accommodated—how unavoidable distortions may be countered and power plays contained.

One group of stakeholders will be scientists working on development issues, who are sceptical of if not hostile to the promotion of indigenous knowledge and participation, perceiving them as an attack on their specialist status (Chambers 1993). This was conveyed to me recently by a biology professor in a letter about overseas development collaboration: "I would prefer to look first for scientific guidance as to the best solution to an over-exploitation problem and then to see how far the solution can be achieved in relation to the traditions and politics of the country involved. Emphasis on research in social anthropology first, I find less satisfactory." This approach is counterproductive; interdisciplinary research is difficult enough without starting off with civil war between disciplines. Promoting a genuinely collaborative atmosphere in which neither scientific nor local interests feel threatened, assuring all parties that they bring vital skills and knowledge to the negotiations, should be a priority. The process involves the brokering of knowledge, for people will inevitably interpret any scientific-technical information that reaches them in the light of their sociocultural position and experience (Hall 1981). This is not a question of undermining natural scientists, as is suggested by anti-positivist social scientists who appear to presume to speak on behalf of the poor, but one of seeking to make scientists' work more effective through partnership. The proposal of the radical farmer-participatory wing that poor producers should set research agendas misrepresents this process, threatening such violence to scientific work as to stop it dead in its tracks. Science determines its own research agenda; the models it uses to understand the world (e.g., the atomic theory of matter) determine the questions that it asks, and to suggest to a research scientist that farmers should set the research agenda would appear incomprehensible and ridiculous (Latour and Woolgar 1979, Pickering 1992). It is unrealistic to think that the scientific community could be persuaded to abandon its successful orthodoxy; it would be unable to make sense of the natural world without

it. The respect of scientists and technicians has to be won, and this is unlikely if one directly challenges the validity of their research. Influencing their priorities in the light of local aspirations and perceptions of problems will require demonstrating how awareness of indigenous knowledge and accommodation of farmer participation will improve their research (Chambers 1980, Schafer 1989). It is crucial that scientists and technicians come to accept that local people, and the poor in particular, should have a prominent voice in development plans and activities that affect their futures (Chambers 1996).

Another group of stakeholders is the population of the country targeted for assistance. These negotiations may be difficult not only because of difficulties in cross-cultural communication and understanding but also because of their inevitable political aspects (Long and Villareal 1994). Different interest groups may interpret research findings quite differently and manipulate them accordingly, attempting to use them to impose their views on others. In parts of Nepal, Thailand, and India it is increasingly common for politically more powerful lowland communities to blame upland shifting cultivators for causing sedimentation and flooding through deforestation (Eckholm 1976, Blaikie, Cameron, and Sneddon 1980, Blaikie and Brookfield 1987, Sen 1992) and to promote schemes involving reforestation, resettlement, national reserves, and so on, that severely disrupt their lives. These judgements are based on sweeping assumptions not yet subject to scientific confirmation and make contentious suppositions regarding indigenous knowledge, assuming it to be locally too specific to encompass degradation occurring on a large regional scale. But a review of the evidence suggests that the case against upland shifting cultivators may be overstated (Zurick 1990) not only in assuming that their activities are contributing massively to degradation problems downstream (Scott and Walter 1993, Forsyth 1996) but also in suggesting that they are unaware of erosion problems and lack technologies for managing their impact (Critchley, Reij, and Willcocks 1994, Gurung 1989, Bjorness 1986, Muller-Boker 1991). Slope measurements, soil erosion rates, and so on, suggest that farmers, aware of soil-loss dangers, are not increasingly cultivating steeper slopes as their populations grow but farming flatter sites more often. The problem is not one of soil loss and its impact on lowland communities but the more familiar one of long-term decline in soil fertility as land comes under increased cultivation pressure. The issue is as much political and social as environmental and scientific; authorities are extending control over remote communities and minority ethnic groups and policing sensitive international boundaries under the guise of protecting the natural environment (Blaikie 1985, Bryant 1992).

The focus on indigenous knowledge and participation threatens power relationships at every level from the local to the international (Long 1989). Indigenous knowledge is not locally homogeneous. Differences will exist along gender, age, class, occupational, and other lines

and among individuals of similar social status (Scoones and Thompson 1994). Caution should perhaps be exercised not to overstate the extent to which knowledge varies between people who share a sociocultural and linguistic heritage, but the fact remains that the interpretation of shared knowledge may differ depending on how it affects people's interests, and there will likely be in-fighting between different interest groups within any community regarding proposed development initiatives (Blunt and Warren 1996, Mosse 1994). This is evident in Bangladesh, where the upland erosion issue and associated interventions, including multilaterally funded engineering measures (embankments, polders, and so on) to effect control of massive flooding and sedimentation (Haggart 1994, Hughes, Adnan, and Dalal-Clayton 1994), have had profound implications for local power relations. Some aspects of the new land management strategy have increased productivity and proved highly profitable in association with new high-yielding rice varieties. Other beneficial spin-offs include increases in managed fish-pond production. These interventions have occurred in a highly stratified and religiously differentiated social system with marked differences in access to wealth and power and rigid gender role discrimination. The richer and politically dominant larger landowners in communities have taken a renewed interest in resource access, seeking to control it further and marginalise poor farmers, fisherpeople, and the landless—which shows how difficult it is to confine technical developments to one segment of society, the poor (Rahman et al. 1994, Wood 1994). Further social changes have ensued, with increased conflicts as people dispute access rights where access was previously unrestricted, as with some open water bodies before the advent of commercial fish stocking. Poor people are struggling to manage in the face of this development onslaught (Brammer 1980). The implications of variations in knowledge and social position within local communities demand assessment. Indigenous-knowledge research has to address the issue of whose knowledge it is going to privilege; can it represent everyone's knowledge, and, if so, what is the intellectual status of this all-encompassing knowledge? The privileging of some knowledge over others will extend a degree of power to those who hold that knowledge; alternatively, making it widely known may undermine the position of its holders.

The disturbance of social relations relates to another important role social anthropologists potentially have to play—helping to predict possible social consequences of development interventions (Cernea 1991). If the policy objective is to assist the poor, some idea of how initiatives will impact on current social arrangements, notably their relations with the more wealthy and powerful, is required. The classic example in the natural-resources field concerns the impact of high-yielding crop varieties on rural society, the so-called green revolution, which some maintain benefited the wealthy more than the poor (Lipton and Longhurst 1989, Shiva 1991). Social scientists failed to predict the

massive social change that followed from these plant-breeding initiatives and sometimes overcompensated for this in their later critiques, failing to acknowledge that the enormous boost in output probably prevented famine in some regions (although sometimes with increasing environmental problems). The social sciences do not have a good track record when it comes to predicting the course of change, and there is a need for considerable methodological innovation here. While social assessments of possible changes emanating from interventions (e.g., social differentiation/impact analysis) should aim to inform policy makers and implementing agencies about possible outcomes, given the ethical issues raised above we should be cautious about promoting particular social changes (for instance, the status of certain occupational, gender, or age groups).

Problems with Expectations

As we have seen, the ethnographic specificity of indigenous-knowledge research presents a considerable barrier to its deployment in development. Swidden farmers, for instance, do not universally value weeds for the protection they afford against soil erosion and nutrient loss. The Kenyah of Kalimantan say that weeds reduce hill-rice yields both by competing for resources and by accommodating pests, and they attempt to keep them down by clear-weeding swiddens and not cultivating short-fallowed plots (Chin 1985). By definition, indigenous-knowledge research is small-scale, culturally specific, and geographically localised, infrequently encompassing regional ecosystems. It is this limitation of perspective that renders people prey to outside political interference in the name of conservation of biodiversity, land resources, or even global environmental protection. The scale problem is further exacerbated by the increasing focus of natural-resources research and development on marginal and fragile environments rather than on better-endowed regions where high production is achievable (Wilken 1989). These marginal and fragile environments are more diverse, making generalisation and the search for widely applicable solutions to production and other problems increasingly difficult (Moock and Rhoades 1992).

The distortions that result from the stereotyping of shifting-cultivation regimes highlight the problems encountered in the pursuit of a generic approach to local knowledge in development. There is a tendency for shifting cultivation to be depicted as a single system, involving the slashing down of natural vegetation, which is burnt to release nutrients and control weedy competitors, followed by site abandonment when crop yields decline unacceptably: "Shifting cultivation in sparsely populated areas enables farmers to keep forest or wilderness at bay through the slash-and-burn method, but enables them to move into other areas when new soil is needed so leaving the previous area to long-term fallow" (Croll and Parkin 1992: 7). But attention to local knowledge and management practices sug-

gests that this farming regime is far from uniform; there are many different types of swidden agriculture, depending on variations in environmental conditions such as soil resources and natural vegetation and in sociocultural traditions and historical circumstances. These variations reflect not any unilineal evolutionary sequence but differing adaptations to environments and various understandings, accumulated over generations, of how best to manage edaphic, floristic, and other natural resources to ensure sustainable production and reliable returns. In the mountainous interior of Papua New Guinea, for example, people cultivate some land intensively. The regime defies characterisation, featuring classic shifting cultivation on some plots, cultivation of others for longer periods, and continuous cultivation of still others with brief periods of grassy fallow, all employing the same technology and procedures. An intriguing feature of the system is that inputs for all gardens are internally derived, whereas the literature on traditional agriculture in the tropics predicts a crash in site productivity over time due to nutrient losses, weed proliferation, soil depletion through erosion, and so on (Sillitoe 1983, 1996). When investigated more closely, the variation evident in such local cultivation practices suggests that research into shifting cultivation in one locale is unlikely to produce results readily transferable elsewhere. The question is at what level they may be applicable: that of the New Guinea highlands, that of Amazonia, or that of a province or river valley. The answer perhaps depends on the nature of the problem researched, but the indications are that it requires a great deal of work to establish the applicability of knowledge gleaned from one setting to another.

A related difficulty with indigenous-knowledge research, intimated earlier, is that it is largely ethnographic reporting of others' production systems. It is not analytical or framed in such a way as to identify and help address scientifically researchable constraints that limit their productivity. It has proved effective in non-governmental organisation (NGO) work conducted by small teams close to a few communities, notably featuring limited appropriate-technology interventions, but has so far had little large-scale impact. Development demands a generic approach. Even in NGO contexts there is scope for a deeper anthropological awareness among those who advocate participatory approaches, but the absence of a recognisable paradigm inhibits its advance in the context of bilaterally and multilaterally funded research and development. Indigenous-knowledge research therefore appears to contribute to the accumulation of exotic ethnographic documentation and databases which are sterile and undynamic from a developmental perspective, even potentially disempowering people by representing their knowledge in ways inaccessible to them and beyond their control and perhaps infringing their intellectual property rights (Agrawal 1995a). The absence of a coherent indigenous-knowledge intellectual framework that might interface effectively with science and technology also contrib-

utes to natural scientists' failure to appreciate it and allow it to inform their research agendas. There is a danger of its appearing an amateurish approach promoted by social scientists ignorant of technical research. We need a professional edge to penetrate the scientific research establishment. But the variation between different societies and even sometimes regions and communities makes generalisation not only difficult but also potentially dangerous. Comparative studies in anthropology that attempt to uncover cross-culturally universal aspects of human behaviour have been notoriously difficult and offer little ready guidance (Brislin 1980). Indeed, the problems encountered and relative lack of success in formulating generalisations about the human condition suggest that some circumspection in the search for generic aspects of indigenous knowledge that meet development's demand may be prudent. Nonetheless, there is an urgent need to evolve methods and formulate principles that will facilitate a degree of reliable generalisation from such research; otherwise we are limited to certain highly successful project-level case studies that cannot cost-effectively be replicated in large numbers. They will add to the ethnographic archive amassed over several generations but, lacking any generic analytical edge, contribute only locally to development efforts.

Understanding another knowledge tradition is indisputably no easy or short-term task. The time scale involved in ethnographic research is considerable, and this presents problems for development projects, with their short-term orientation and politically driven requirement of quick returns. One priority should be to convince policy makers that indigenous-knowledge research is long-term. It is sometimes alarming what those involved in development think that anthropological research methods can and should deliver. While there may be a place for rapid rural appraisal, participatory rural appraisal, and so on, in some development contexts (and anthropologists familiar with a region may be able to undertake such work with a fairly reliable return on their efforts [Chambers 1987, 1992; Gujit and Cornwall 1995]), these are not and cannot substitute for anthropologically informed research. It can take several years, not months or weeks, for someone unacquainted with a region to achieve anthropological insight into local knowledge and practices and from this perspective perhaps illuminate technical and other development-related problems. The approach may prove incompatible with development contexts. If so, it is necessary to point out the possible costs of any necessary compromise, for any approach is only as good as the opportunity afforded it. It is not just a question of the time it takes to learn language, cultural repertoire, social scenario, and so on, but also a matter of the investment needed to win the trust and confidence of people who frequently have reason to be extremely suspicious of foreigners and their intentions. The central anthropological dictum of holism underlines the need for a long-range perspective and anticipates the dy-

namic and negotiated status of indigenous-knowledge research. While the interconnectivity of issues is acknowledged in development contexts, as is evidenced in approaches such as “integrated rural development” and “farming systems research,” this insight has fallen foul, under the time pressures of development, of holism’s all-encompassing contradictions. These starkly demand that socioculturally speaking we know either everything or nothing. It is the functionalist conundrum that has long faced anthropologists of striking a balance between the requirement of achieving a detailed understanding of something, which by definition implies narrowing the field of enquiry, without becoming too narrowly focused and overlooking connections to other issues. In indigenous-knowledge research it amounts to maintaining a broad sociocultural perspective to contextualize the tightly focused view of technical specialists.

This raises further intriguing methodological issues and possibilities which merit investigation. Perhaps it would prove more time- and cost-effective in development contexts to employ nationals from the region to research indigenous knowledge instead of outsiders. Already familiar with language and culture, they may proceed with the necessary research more quickly and effectively. Adequately briefed indigenous researchers can also warn people about intellectual property rights issues and help them decide on appropriate action regarding potentially exploitable knowledge without commercially influenced outsider interference (Posey, Dutfield, and Plenderleith 1995). But this approach predictably has pitfalls too. First, there is the danger of creating gatekeepers who accumulate power over the lives of others, for instance, regarding their rights (although this danger applies equally to outsiders). Secondly, it may subvert anthropological enquiry, which assumes that outsiders “see” things differently to insiders and ask awkward questions; for example, religious beliefs and observances are beyond question to many people. With the current intellectual diaspora and explosion of emphatically insider sociological studies, the definition of the discipline of anthropology itself is in contention, but “ordinary” folk remain the focus. Thirdly, finding nationals willing to undertake anthropological research, which may involve living with the poor and looked-down-upon for extended periods of time, is a potential problem with loss-of-face implications. And poor local people may be even more suspicious of the intentions and motives of a privileged and educated fellow citizen than they would be of a less informed and disinterested foreigner. One answer may be a mixture of personnel, with different disciplinary and cultural backgrounds, briefed to consider indigenous-knowledge issues as part of their multidisciplinary work. This raises further potentially tricky issues relating to balance of work, coordination, facilitation, and so on, but it poses intriguing questions for anthropological method regarding the relatively little-explored intellectual implications of cross-cultural academic collabora-

tion—of anthropological outsiders with sociological insiders working together with natural scientists—and it relates too to the crisis of representation that besets the discipline.

It is widely agreed in development circles that it is necessary to appreciate something about local perspectives; the problem is how to achieve this and contribute meaningfully to the development effort. It is clearly not a matter of simply incorporating anthropological methods into the development research repertoire—transferring research techniques such as participant-observation, whatever that self-contradictory but lauded approach implies (Agar 1986, Cox et al. 1995, Spradley 1980). They are a start, nonetheless, and might be refined to meet development demands. Furthermore, while any sensitive individual can become acquainted with anthropological research methods, just as anyone can learn technical matters relating to irrigation, soil erosion, plant breeding, or whatever, these are best improved upon within the discipline that has experience of the problems that attend them (Werner and Schoepfle 1987a, b). It makes sense to proceed from and so anticipate mistakes already made and ethical dilemmas already faced.

There is considerable scope and increasing demand for the refining and reforming of anthropological methods to meet development requirements. These opportunities bear intimately on the much debated future of anthropology. They are a way forward beyond the controversies stirred up by recent postmodern criticisms of the discipline’s achievements, criticisms which, although they have strangely ignored methods, relate in no small measure to fieldwork practice. Any attempt to improve on current ethnographic techniques will be assessed according to its development relevance and effectiveness. There is a need to demonstrate that the extra resources and time expended on anthropologically informed research are worth it. We shall be assessed, in the spirit of the age, against the reliability and usefulness of the information we collect.

Comments

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Sillitoe makes an important contribution by acknowledging and reviewing the greater role being given to indigenous knowledge in development. I agree with him about the importance of interdisciplinary teamwork. Agricultural scientists are now more open to collaboration with anthropologists, and for us learning about another discipline through the study of the folk science of a traditional people can be fascinating. Brokering information between scientists and smallholders can help

both create more productive, environmentally sound agriculture. As Sillitoe indicates, most agricultural scientists reject the idea that peasant farmers should set the whole research agenda, but they are open to the idea of making the research agenda serve farmers better. Anthropologists can interpret farmers' research needs and help to incorporate them into the formal research agenda.

Development work is changing. While the Green Revolution has achieved large increases in food supply, even among smallholders (see, e.g., Jirström 1996, Tripp 1996), it is nearing the end of what it can accomplish. Modern crop varieties and chemical fertilizers are already being widely used and earning diminishing returns (Bentley, Castaño-Zapata, and Andrews 1995, Rola and Pingali 1993). The next generation of agricultural technology, including integrated pest management and soil conservation, is more location-specific and orders of magnitude more information-intensive than Green Revolution varieties and fertilizers. The transition from capital-intensive to information-intensive development technologies is opening the door for a new appreciation of indigenous knowledge. Anthropologists can help development become more humane and effective. As Sillitoe suggests, there is now more room for anthropology and a more appropriate role for anthropologists in development work.

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Sillitoe's thoughtful, comprehensive, and insightful article belongs firmly in the ranks of the "Anthropology, Whither Now?" pieces that are regularly published, and it is one of the best of these. He is realistic, for example, on the limitations and prospects for indigenous knowledge and on the importance of broader political factors. He critically and deftly analyzes the possible role of anthropology in development, working in partnership with both scientists and local people, pointing out the many potential pitfalls. He also deals with such delicate areas as the question of intellectual property rights, warning of the dangers of what Robert Chambers has called "the mining of indigenous knowledge." He shows a commendable ethnographic breadth, drawing mainly from Papua New Guinea and Nepal but being aware of studies from other parts. I have several mostly minor comments, none of which detracts from the basic importance of this article.

The opening sentence states that "a revolution is occurring . . . as the development world changes its focus from top-down . . . to grassroots." This is hardly a revolution but rather the acceleration of a gradual process that has been going on at least since the 1950s, and it still has a long way to go.

There are many references to scientists (natural or Western), usually depicted as being in opposition to an-

thropologists. However, I have found that scientists, especially when encountered in the field, are seldom hostile to or even skeptical about indigenous knowledge; if anything, they sometimes tend to exaggerate what anthropologists know and how we can help.

Other stakeholders or actors in the development drama are mentioned briefly but warrant closer attention. I think particularly of administrators; USAID mission directors, for example, wield tremendous power and influence, often more than that of U.S. ambassadors, simply because of the funds that they control. This applies, in varying degrees, to field heads of other donor agencies and to senior officials in the "host government." These sorts of people are inclined to be more skeptical of indigenous knowledge than scientists. Some African officials have an ambivalent attitude to indigenous knowledge, on the one hand being proud of their ancestors' insights and knowledge, on the other being embarrassed about supporting something so "unscientific."

Nongovernmental organizations, again, receive only passing mention, but they are becoming increasingly important stakeholders in development. The major Northern ones (e.g., OXFAM, Christian Aid, Save the Children Fund, CAFOD) usually regard indigenous knowledge with favor even if—as is the case with many donor agencies too—they are not sure how best to use it. There are signs that Southern NGOs are beginning to lay claim to being guardians of indigenous knowledge and of resenting and resisting attempts by any outsiders, including Northern NGOs, to investigate or to use "their" indigenous knowledge. This is an ominous development, especially as Sillitoe rightly says that "negotiations ideally should involve all stakeholders."

Sillitoe is doubtful about the value of rapid rural appraisal, tending to insist on the need for thorough, long-term ethnographic research. However, (1) it is in most cases better than nothing, which is so often the only alternative; (2) providing that the anthropologist is familiar both with the region and with the topic, he/she can make a meaningful contribution; and (3) full-scale local ethnography is simply not practicable for all development projects, given the multiplicity of projects in any one country.

Although Sillitoe is aware of the problems of reaching the poor, he could have said that it is often virtually impossible; he could also have written about the danger that the rich (i.e., the relatively "rich" rural people), usually men, will capture the benefits of development projects no matter what safeguards are put in place.

The article deals mainly with the domains of agriculture and health; perhaps something could have been included about two domains where indigenous knowledge has been systematically explored and described—social forestry and pastoral societies (for the latter, see Dyson-Hudson 1991).

Sillitoe disapproves of other disciplines' investigating indigenous knowledge. I do not think that we should be competitive; there is so much to do, and there have been so many first-class contributions to the field of in-

indigenous knowledge and development from other disciplines.

There is no mention of problems within the discipline of anthropology, where many practitioners are quite as skeptical of or hostile toward any involvement with development as the scientists mentioned. I have encountered these attitudes more frequently in Britain than in North America, though they crop up everywhere.

Sillitoe cautions against overstating the extent to which knowledge varies between people who share a sociocultural and linguistic heritage. In our fieldwork in Kenya (Riley and Brokensha 1988) we were constantly impressed by the considerable differences in individual knowledge about local plants—hardly surprising if one considers the variations in our own society in knowledge of, say, music or electricity or gardening: idiosyncratic differences should not be disregarded.

Finally, it may seem churlish to criticize the bibliography, which is generous and includes most of the relevant references and many, I admit, that are new to me. However, mention might have been made of some of the pioneering studies of the 1950s and 1960s—works such as that of de Schlippe (1956) on shifting cultivation in central Africa, Foster (1967) on Mexican agriculture, Paul (1955) on health, and Conklin (1957) on shifting cultivation in the Philippines.

Regarding the next suggestion, I have to declare a personal interest, as I am both a director (together with Michael Horowitz and Thayer Scudder) of the Institute for Development Anthropology (IDA) and a coeditor (with D. Michael Warren and L. Jan Slikkerveer) of the Intermediate Technology Publications Series on Indigenous Knowledge. IDA has published a series of useful books, working papers, and newsletters in the 30 years of its existence. Perhaps because it is located in the U.S.A. (Binghamton, New York) it is not widely known in Britain. The Intermediate Technology Series on Indigenous Knowledge started in 1995 with the publication of Warren, Slikkerveer, and Brokensha, *The Cultural Dimensions of Development: Indigenous Knowledge*, a far-reaching overview, and the series now includes ten volumes.

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Sillitoe's review of the role of indigenous knowledge in the future development of applied anthropology is challenging and insightful. It is the kind of objective thinking that we need in fashioning an anthropology that is more relevant to the problems facing people today. Much of sociocultural anthropology, while disdaining active involvement in development because of ethical problems, fails to see the ethical (including intellectual property) problems involved in all appropriation of knowledge and thus in all of anthropology. Applied an-

thropology might strive to set the use of local knowledge within a broad environmental and political perspective that promotes equitable collaboration by all parties in decision making.

I very much agree with Sillitoe's call for increased communication between natural scientists, social scientists, and local peoples and, regrettably, with his assessment that there is no consensus on the best way forward. Part of the problem with reaching consensus is the lack of reflection on the complex roles that values, empiricism, and theory play in understanding natural phenomena. Sillitoe assumes that the perspective of natural science is foreign to other cultural traditions, but perspective in the sense of epistemology is different from perspective in terms of scale (one can't see molecules with the naked eye). While local peoples' epistemology may be complex (Scoones and Thompson 1993), so too may that of scientists, for example, plant breeders (Duvick 1996). Formal scientists communicate in "nonwritten," "pragmatic," and contextual ways also. Therefore, while I agree that development should involve negotiation among all parties, I disagree with the statement that science determines its own research agenda and that therefore local farmers cannot set the research agenda. Why cannot there be collaboration here too?

While the problems of communication between different parties are immense, Sillitoe says that the acid test of development projects, and by implication applied anthropology, is the modification of local procedures or the adoption of new ones. This can mean "improvement" in terms of outsiders' objective measurements and in terms of local people's objective measurements, their perceptions and feelings. I would go farther, building on some of Sillitoe's other ideas. Success depends in a broader sense not on adoption or modification but on what the long-term results in social, cultural, economic, and environmental terms are for the local people and the world. This challenges the concept of cultural relativism (Cleveland 1994). In an increasingly crowded and interconnected world, moral codes and natural-resource management regimes can no longer be judged only subjectively from the local perspective, because all activities affect other groups with different moral codes and different management strategies. In other words, we need to evaluate local solutions in global contexts of social, economic, and environmental sustainability. Rights to intellectual or physical property, for example, are likely to be defined contingently, on the basis of sustainability, and not intrinsically, on the basis of local people's myths or values (Cleveland and Murray 1997). Yet "sustainability" is a subjective concept and thus requires negotiation over values before agreement on the best objective measures of the variables in a given definition.

I applaud Sillitoe's call for "facilitatory" anthropological research methods that unite anthropological skills with technical and scientific knowledge. This is necessary if we are to question not only the sociocultural implications of directed change and applied science but

the assumptions on which economic development and natural science are based. Too much sociocultural anthropology is ignorant of the science it critiques and thus reduced either to promoting the technical changes recommended by natural scientists or critiquing the results. Anthropologists need to study the culture of science not from a postmodernist perspective that rejects its ontology and epistemology from the start but with the same empathy with which they have traditionally approached local communities. Efforts like those of Nader (1996) offer a more promising way forward.

Sillitoe's observation that an anthropological focus alone has little to recommend it and that anthropology will be judged by its relevance to the pressing problems of the day suggests to me that anthropology will survive as a separate discipline only if it actively seeks to build on its traditions by integrating the perspectives of the humanities, social science, and natural science in understanding the integration of the local with the global.

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It is not a promising start if, when expounding the virtues of a kind of knowledge, it is impossible to agree what it is. As Sillitoe implies by the use of inverted commas around "science" and as he indicates in his opening remarks on the difficulties of labels such as "indigenous," this is contentious and disputed ground. Yet despite the difficulties of defining and characterising a form of knowledge we seek to interrogate and evaluate, we have an obligation to try, even if the characterisation seems pretty wobbly and even if it subsequently becomes necessary to rethink from first principles. As a beginning, and without claiming any particular originality, I suggest the following: local, orally transmitted, a consequence of practical engagement reinforced by experience, empirical rather than theoretical, repetitive, fluid and negotiable, shared but asymmetrically distributed, largely functional, and embedded in a more encompassing cultural matrix (Ellen and Harris 1997). Of course, the problem is that this definition, like many in anthropology, is at least in part formulated as a negative: that which is not epitomised by being part of a dominant Western scientific knowledge. It is for this reason that we have difficulties in finding its direct equivalent in Western culture, except by recourse to the quaint and the folksy. A major difficulty with ruling conceptions of indigenous knowledge is that they do not generally imply what is, in fact, a living and dynamic tacit knowledge interfacing with *all* spheres of human activity in *all* societies, "not"—to use Sillitoe's words—"separated from the world," and including the most sophisticated modern technology. Time-consuming and irrelevant as it may seem to practitioners, the intellectual work involved in making these connections is essential to understanding how and when we can

most appropriately apply the lessons of indigenous knowledge.

What greatly offends, quite rightly, so many anthropologists is the way indigenous knowledge is used by some as the new "quick fix." We find it as conveniently repackaged bits of knowledge (Sillitoe's "independent technical facts") which, it is claimed, can be garnered under conditions of rapid rural appraisal in the context of so-called participatory and farming-systems approaches and thereafter slotted into what remains an essentially top-down paradigm. What is particularly problematic here is that collecting and applying indigenous knowledge is deceptively easy. Indeed, certain kinds of indigenous knowledge (especially ethnobotany) appear to be so accessible to researchers with little training and time that they are regularly promoted as areas of investigation suitable for student expeditions of the kind sponsored by the British Royal Geographical Society. The difficulty—and danger—here is that an uninformed researcher collecting data during a short time-frame and as part of a highly structured organisation is not able to know a priori what can be accurately and safely reported as knowledge and recycled in useful ways. The result is that many so-called indigenous-knowledge reports radically disembodiment particular bits of proclaimed useful knowledge from the rest of culture in a way which does a profound disservice to its potential importance. But to criticise by simply asserting that "all knowledge is culturally embedded" invites the response that this is no more than a shibboleth which conveniently protects the interests of a particular professional cadre—namely, anthropologists. It is necessary to get beyond the shibboleth and show by example—as Sillitoe recommends, and does in his own work—that applied indigenous-knowledge research must be grounded in an in-depth understanding of the local culture (in other words, "proper ethnography"), that technical assistance must be coupled with cultural awareness. What makes this level of reflexivity even more crucial nowadays is that local people and governments (who may see indigenous knowledge as a state resource) are increasingly reflecting on their own knowledge, simplifying it and changing it for ideological and legal convenience, and reconstruing it in ways which provide them with an income.

Work on indigenous knowledge often lacks theoretical and methodological coherence precisely because it has been scientised and rewrapped in ways which are distinct from existing anthropological theories of knowledge. Whatever views we may have of work over the past 20 years in anthropological ethnobiology (which covers much of the same substantive ground as that which interests the development practitioners), it has lacked neither methodological rigour nor theoretical sophistication. However, it is precisely this theorised knowledge which has informed the accumulation of "exotic ethnographic documentation and databases which are sterile and undynamic . . . even potentially disempowering people by representing their knowledge in ways . . . beyond their control." The knowledge is

largely “classificatory knowledge,” usually lexically grounded, and the organisation of categories imputed to be “indigenous” is not always recognisable to local peoples because of their radically abstract re-presentation. What is much more difficult but no less necessary and still a real intellectual challenge is to ground local knowledge—in this example, ethnobiological knowledge—theoretically in a way which integrates and encompasses in-depth knowledge of particular species as well as broad knowledge of numerous species, synecological as well as autoecological knowledge, and knowledge of different biotopes within broad categories of habitat such as forest, all of which is intrinsically variable and subject to change (Ellen 1996). One problem for anthropologists and development practitioners alike is the tendency to assume that all knowledge worth having is encoded verbally and can be articulated by local people. Increasingly, it is clear that much practical cultural knowledge is not stored in this way but is absorbed by doing, watching, and living a particular way of life. “If one is a farmer,” says Sillitoe, “one just knows.” It is imperative to incorporate this into anthropological theories of knowledge, which are still overly language-based.

I believe that many of the problems with indigenous-knowledge research stem from the assumption that the knowledge to be retrieved is empirical knowledge, about particular things or groups of things, rather than a set of procedures for discovering the nature of the world and then modifying it in ways to make it more useful. This is certainly the case in ethnobotanical research (Ellen 1996). Dove (n.d.) has recently supplied us with a nice example of how indigenous (in this case, Amerindian) knowledge of rubber trees packaged by European scientists and transplanted to Southeast Asian plantations proved less useful than the empirical ignorance of rubber on the part of Malay smallholders combined with their sophisticated ethnoecological knowledge of the local environment into which the cultigen was introduced.

It is true that some peoples do make rational choices and discard low-tech solutions which sustain culture and environment in the long term in favour of high-tech solutions which provide immediate benefits but store up problems for the future. This can be seen in the behaviour of upland Baduy in western Java, who engage in a trade-off between using chemical pesticides to achieve short-term economic gain and maintaining their cultural identity by participating in rituals which require that they *not* use pesticides. At the same time, other Baduy make a very different compromise by planting the introduced leguminous tree *Albizia* in swidden fallows to recycle land more quickly and to provide a salable crop in the form of quick-growing timber and fuel wood. In this way they are able to maintain a swiddening system which is crucial to their traditional identity (Iskandar 1997). Not all local people will, however, be satisfied with such low-tech solutions to their problems, and some may indeed consider that they are being “fobbed off.” This is where the right feedback is essen-

tial and where a true partnership with science may pay off, as in the screening of local plant remedies in Sabah to help people evaluate further the usefulness of their traditional pharmacopoeia (Martin 1995:91–93). Some of what Sillitoe is asking for has already been achieved, for example, in the work of Paul Richards, who more than most has provided that “professional edge to penetrate the scientific research establishment.” My experience is that many scientists (though not all) are now willing to learn but have little real understanding of how useful ethnographic knowledge needs to be produced and can find few anthropologists able to present their expertise in ways which makes it accessible to scientists, let alone the local population. Part of this involves learning how to present ethnography as “user-friendly” and undeniably requires some imagination. I agree that “it is not true that we either must know it all or know nothing” and that we “need to avoid . . . taking the sociocultural embeddedness issue too far.” What the anthropologist should be professionally competent to judge is just *how far* we can realistically disembodify particular knowledge before it ceases to be useful.

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Sillitoe argues that the focus on empowerment, participation, and indigenous knowledge in recent development practice is producing a revolutionary shift in applied anthropology. He welcomes this change and urges his anthropological colleagues to jump on the indigenous-knowledge bandwagon before other specialists “steal our disciplinary clothes.” He is not concerned, however, with another theft that should alarm us even more. Sadly, the interest of most specialists in indigenous knowledge does not grow out of respect and admiration for other people’s lore. Few study the subject with the purpose of contributing to the well-being of indigenous people through constructive dialogue aimed at finding solutions to problems resulting from new environmental conditions. Then, too, there is the question of whether the Habermasian ideal of undistorted communication and the full participation of individuals as equals is possible.

Scientists’ involvement is not disinterested; for many, indigenous knowledge has become a valuable commodity which can be patented and copyrighted (see, e.g., Shiva 1997, Greaves 1994). Many experts also contend that indigenous knowledge can be systematized, stored, manipulated, and made intelligible to others independent of the historical and spatial context in which it was produced—a contention that a number of critiques are currently challenging. Participants in development are not innocent players. Nor do they enter the development arena as equals. Some advocate a romanticized vision of indigenous-knowledge systems as tradi-

tional and ecologically sound, projecting onto them their own critiques of modernity and hence promoting the conservation of peoples and their lores as they imagine they should be; others promote "technological achievements" and assume, as Sillitoe does (albeit at times with some ambiguity), that "poor farmers given unrestricted access to scientific technology would likely choose industrial fertilizers." As anthropologists, we have to be wary of assertions such as this one affirming that "non-Westerners" want certain commodities and are eager to enter the cash economy. How does the unequal relationship between self and other structure desire and fantasy, and how does it guide our consumption patterns? Assumptions about development and indigenous knowledge need to be carefully examined. Is development always desirable? Do development practices promote the well-being of the poor? Should we uncritically accept the cost-effective discourse of development planners when it comes to discussing social and environmental problems? How does power operate in development? Who determines development relevance and resource effectiveness if we acknowledge, as Sillitoe seems to, that the introduction of technological innovations is inevitably political?

Further, indigenous knowledge is a contested concept. "Indigenous knowledge" here is the knowledge of an other who becomes defined in opposition to an authoritative "we," vaguely presented as scientists from the West (experts in hard, natural "systems," gender-neutral privileged enlightened revealers of truth). Where anthropology—as Sillitoe understands it—stands in this dichotomy is hard to say, although he seems to be saying that the discipline reserves for itself the role of mediator between two autonomous systems. Even though anthropology and other social sciences have been addressing for some time the problems entailed in thinking of the world in terms of antinomies such as the one presented here—scientific (Western) knowledge versus indigenous knowledge—this paper is a good example of how well-entrenched these dichotomies are. Each pole is assumed as a totality with an internal logic and independent of the other. This view oversimplifies social phenomena and precludes any possibility of mediation by assuming one pole as the active subject, Sillitoe's "we," and another pole as his vague "they," the passive, confused, ignorant, and ultimately irrational other (although he is careful not to use these terms). Recent debates have shown how both the "we" and the "they" need to be carefully scrutinized, as essentialization and reification are present in Orientalism as well as in Occidentalism. By polarizing the scientific and the indigenous into two separate and distinct forms of knowledge, Sillitoe makes his goal of some consensus unattainable. If, as he seems to suggest, indigenous knowledge is local, context-dependent, small-scale, and culturally specific, can he still expect to "evolve methods and formulate principles that will facilitate a degree of reliable generalization"?

At times, Sillitoe seems to suggest that Western

"technological innovations" such as inorganic fertilizers may become indigenous knowledge when farmers attempt to employ them in ways that are not necessarily ecologically savvy. I wonder if it is adequate to speak of indigenous knowledge with reference to practices that have emerged in response to very specific environmental stresses recently introduced in peasant, indigenous, and/or farming communities. What makes a knowledge indigenous? The user? The inability of the practitioner to systematize and abstract the principles guiding his/her behavior? Is indigenous knowledge a habitus in the Bourdieuan sense? And if it is, shouldn't we be addressing how these supposedly independent knowledges are implicated in each other? Is it possible "to make connections between local peoples' understandings and practices and those of outside researchers and development workers" without analyzing who does the connecting, for what purpose, and from what vantage point?

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Sillitoe's paper is a clear and timely call to avoid disciplinary divides and instead to collect and use environmental knowledge more closely in association with local people's needs. The paper is addressed to anthropologists, but it also concerns non-anthropologists (such as myself) involved in environment and development research. Indeed, Sillitoe's arguments reflect a new and growing trend towards the integration of natural and social environmental science.

What is environmental knowledge? For years, researchers have been collecting information about environment in the old disciplinary clothes of either the natural or the social sciences. Indeed, much anthropological research (particularly that conducted in the tradition of cultural ecology, such as that of Conklin [1954] and Netting [1993]) has been notable for refuting highly simplified statements and accounts of environmental change made by positivists and instead stressing the adaptability and environmental-management skills of farming communities. Indeed, Sillitoe's own work on upland farmers in Papua New Guinea is an excellent example of this and one that is appreciated by researchers outside the discipline (see Batterbury, Forsyth, and Thomson 1997).

Yet instead of seeking further idiographic description of local environmental adaptation among local communities, Sillitoe calls upon researchers to use indigenous knowledge as the basis for a new approach to environmental science that integrates description with the prediction sought by natural science. By using indigenous knowledge in this way researchers may achieve the dual goal of making their efforts more relevant to the development process and learning more about the nature of

environmental change. In effect, this means adopting a critical stance to environmental knowledge—insisting that biophysical reality (including processes like soil erosion or water flow) exists independently of human experience but all explanations of these processes reflect social and political constructions. Global constructions of science may be just as constructed as local perceptions or indigenous knowledge (see Latour and Woolgar 1986, Agrawal 1995).

A good example is the case of environmental degradation in mountainous humid zones. During the 1970s it was fashionable to believe that population growth in the Himalayas would lead to a vicious circle of deforestation and soil erosion ending in ecological collapse. This concept was summarised by Eckholm in *Losing Ground* (1976) and became known as the “theory of Himalayan environmental degradation.” Since then, many anthropological studies have indicated that this theory is wrong and that hill farmers may actually adapt well to biophysical processes that preexisted agriculture (see Thompson, Warburton, and Hatley 1986). Yet, perhaps more important, researchers recognized that the concept of losing ground had dominated environmental policy and research but was itself a construction reflecting eco-catastrophist concerns in Europe and North America and the uncritical acceptance of natural science and positivism as the basis for environmental understanding. Anthropological research, in the manner proposed by Sillitoe, can not only provide examples of where such understandings are wrong but also produce new statements about biophysical processes reflecting the agendas and criteria of groups targeted for development (Sillitoe 1993).

This use of different environmental knowledge and techniques in a blended natural and social science is increasingly being called “hybrid research.” Hybrid research is the use of several disciplinary approaches to generate various forms of environmental knowledge about biophysical processes that are “externally real” to human experience. Yet Sillitoe urges that, rather than leaving different approaches contradicting each other as in the past, we use this diverse knowledge reflexively in order to indicate environmental change which is common to us all. In addition to this, the term “hybrid structures” refers to concepts or theories about environment reflecting the construction of knowledge about real environmental change (Latour 1992). Many current orthodox models of environmental explanation reflect histories of scientific inquiry under different political and social agendas. Each of these agendas collected knowledge selectively and for different purposes but is commonly taken to reflect “truth” rather than an incomplete and variegated compound of environmental knowledge which may be inaccurate or at least exclusive. Indeed, the concept of “desertification” is now considered an example of such a hybrid construct (see Thomas and Middleton 1994, Leach and Mearns 1996). Hence, Sillitoe argues that the priority for environmental researchers is to gather indigenous knowledge in or-

der to reform constructs of scientific explanation in favor of local agendas—not to discover a “correct” or “final” explanation but instead to make environmental explanation more relevant to people in need.

Such reorganization of environmental research, viewed as a “citizen science” in Europe and North America (Irwin 1995), is still limited in the developing world. There is a need to advance environmental understanding and policy in developing countries by gathering indigenous knowledge and realigning orthodox (and largely Northern-dominated) environmental thinking. Sillitoe’s approach achieves both an empowerment of local knowledge and an acceptance that any knowledge from any one source has to be evaluated alongside others. My belief is that this may result in more relevant research and more reflexive and politically aware environmental explanation.

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I endorse Sillitoe’s call for anthropologists to enter into the euphoria of the “participatory approach to development,” but his cumbersome analysis leaves something to be desired.

First and foremost, he ignores much of the political context in which the “revolution” (an overenthusiastic assessment in my opinion) is taking place: for example, the advanced debates on implementing in situ conservation, the Convention on Biological Diversity (CBD), the role of farmers’ rights in revision of the Food and Agriculture Organization’s International Undertaking on Plant Genetic Resources, and the negotiations to develop social and participatory forest management principles in an international convention on forests. Advances in the rights of “indigenous and local communities” (terms used in the CBD and the Convention to Combat Desertification) have also occurred as a result of the Human Rights Conference in Vienna, the Social Summit, and the conclusion of the Draft Declaration of Rights of Indigenous Peoples. Anthropologists have played significant roles in all of these processes, which have helped to establish the conceptual and legal underpinnings that guarantee community participation.

Furthermore, anthropologists have made considerable contributions to the growing respect for traditional knowledge (traditional ecological knowledge, local knowledge, etc.) through cognitive, ecological, ethno-taxonomic, and ethnobiological studies. Folk taxonomies, for example, have been shown to share principles of classification with Western science (and often exceed them in detail of morphological, behavioral, and/or utilitarian features), and myths have been shown to encode environmental knowledge systematically at a theoretical level. It is not, then, as clear-cut as Sillitoe

states: that indigenous knowledge systems have no explanatory models that are "equivalent to that of scientific theory." (I would enjoy arguing against his statement, for example, that there are no concepts of "molecules" or "phase functions" in indigenous knowledge, but that would take considerably more time and space than is available for these comments.)

Sillitoe has certainly flagged the problematic areas of interpreting indigenous knowledge and the difficulties of establishing an "interface" between development models and local knowledge systems. The tendency has indeed been for anthropologists (and particularly those who use anthropology) to romanticize or oversystematize indigenous knowledge. Indigenous peoples themselves abhor these excesses. The most onerous aspect of this interpretation, however, is that it is not just "us" helping "them" (which Sillitoe does attack) but "us" deciding whether indigenous beliefs and practices "are" or "are not" scientific (whether or not they are "magic" in Sillitoe's analysis), conservationist, or politically viable. From an indigenous viewpoint, therefore, the "revolution"—with or without anthropologists—is just the white man of another shade (albeit a more suave pastel of stark colonialism). If there is a revolution regarding indigenous knowledge and community participation, then it has come from advances in international human rights and recognition of indigenous and traditional peoples in international law. Guarantees of full disclosure of intent, prior informed consent by communities, and local control over access to land, territory, and resources now make "doing anthropology" a very different process. We too have to negotiate with communities (or appropriate social or political groups) the terms under which we conceptualize our research problems, implement our projects, manage/distribute our results, and develop intellectual property rights arrangements. It is these experiences that will transform anthropology—and, in turn, put anthropologists in the center of development debates. But the transformation will not come from "inputting" into the community development process: it will come when we realize that anthropological research is often a vehicle for the appropriation—not protection—of indigenous knowledge, and this problem will be overcome only when anthropologists become researchers for and consultants to indigenous peoples and traditional communities themselves (e.g., in community-controlled research). That will establish the "dialogue" that Sillitoe rightly views as the cornerstone of a new applied anthropology. In this vein, I think the greatest challenge to anthropology vis-à-vis the development debate is to develop criteria and indicators for sustainable development (or health environments, sustainable livelihoods, etc.) that are based on local/indigenous perceptions, classifications, and values, measures of environmental quality and change that reflect local observations and knowledge systems, and prioritization of projects based on local beliefs—even if they seem "magical," whimsical, or destructive to the outsider.

Fundamentally I agree with Sillitoe. Studies of traditional knowledge are important in the development of a "new applied anthropology." But there will be nothing "new" if we do not develop new methodologies for dialogue with local knowledge holders. And those will not emerge until indigenous peoples have political and economic parity with development forces—and anthropologists. Thus, if there is to be a new applied anthropology, it will have to weave the (often dreary and tedious) discourse on traditional knowledge into political actions that ensure the rights of indigenous peoples to define themselves, their knowledge, and our access to it.

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Sillitoe is to be congratulated on his comprehensive overview of the present state of debate concerning the role of indigenous knowledge in development and the potential role of anthropologists in the development process. In a sense, his paper takes the form of a manifesto for the renewed involvement of anthropology as an applied discipline in development and the engagement of anthropologists with what he identifies as the "spirit of the age." Such an ambitious paper raises many more issues than can be discussed in this short note, but three problems seem to me to be of primary importance.

The first of these concerns the very concept of "indigenous knowledge." What precisely is involved in this concept is nowhere defined. Clearly, it could be taken to cover an enormous field. No matter how it is defined, it will remain problematic. Sillitoe, rightly to my mind, comments that there are major problems in interpreting what passes as indigenous knowledge and points to the importance of recognising the embeddedness or contextual nature of customary thought and practice. Yet this can also be said of scientific and technical knowledge, and the binary distinction made in this paper is surely difficult to sustain. Furthermore, and as Sillitoe in part recognises, there is a problem over the ways in which different forms of knowledge are counterposed. What happens in practice is that scientific or technical knowledge is used as a means to differentiate between "useful" or "correct" indigenous knowledge and "useless" or "incorrect" indigenous knowledge. Thus much of what could be seen as indigenous knowledge is relegated to "superstition" or "symbolism" and marginalised in many discussions. Indeed, the more messianic proponents of indigenous knowledge are guilty of producing a highly sanitised version of the "customs and practices" of non-Western groups. More generally, whilst Sillitoe warns us against ethnocentricity there is also the danger of its opposite—of idealising indigenous knowledge. Yet precisely how we might avoid these dangers is not clear, and a middle path may not be the best.

What we are dealing with here is the relationship not

simply between different ways of knowing but between different social and cultural systems. A central issue here concerns relations of power and domination which are only addressed in passing in this paper. Sillitoe rightly notes that the growing interest in indigenous knowledge is linked to the rejection of "top-down" approaches to development and a stress on "participatory" approaches which "empower" the poor and the marginal. Laudable though such an approach might be, in practice it runs the risk of reproducing old dichotomies and hierarchies in new ways. The rhetoric of participatory development frequently disguises the ways in which old and new elites at local, regional, and national levels can retain or gain control over resources. The growing preoccupation with indigenous knowledge can do little to temper such tendencies. Furthermore, what passes as an interest in indigenous knowledge can at times be little more than a means by which commercial interests gain control over what were previously free resources, for instance, various strains of plants. An interest in indigenous knowledge can thus have a disempowering impact on the poor. What is perhaps needed here is a more nuanced treatment of the political context within which various forms of knowledge have to be understood.

This brings me to my third point, which concerns what one might call the practicalities of development interventions. At one level this paper is concerned with the possibilities of interdisciplinary research, and it rightly stresses the need for cooperation between various interdisciplinary specialisms and specialists. Yet in many contexts this already takes place. Much research on, for instance, fishing, agriculture, and aquaculture does involve anthropologists working with natural scientists as well as involving a range of nationalities. Some of the points made in this paper are directed at the past rather than the present. What is perhaps more important is how the results of this research can be used in the development process. Here once again the key factors are, I suspect, social and cultural rather than methodological. The complex contexts in which development workers (as distinct from development researchers) operate are often such that operationalising the insights gained from imaginative research programmes is an extremely difficult process. The result is that the products of successful research programmes are rarely utilised in the practice of development. Perhaps here lies the real challenge: how to integrate the insights of anthropologists into the practice as well as the theory of development interventions.

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Sillitoe has provided us an extremely well-argued and well-documented paper making a case for better, and

more central, integration of anthropology into the development enterprise. He places special emphasis on the possibility that what he calls a new specialism in indigenous knowledge, based on sustained ethnographic research, will provide a productive space for interdisciplinary collaboration with the natural sciences. "The idea of harnessing anthropology to technical knowledge to facilitate development puts the discipline where it should be, at the centre of the development process." I agree completely with him on these points. Anthropologists since at least the early 1970s, with the emergence of ethnoscience, have argued for the importance of indigenous knowledge to successful development planning. Certainly these ideas were well entrenched, at least among anthropologists, by the mid-1980s (see, e.g., Richards 1985; Chambers et al. 1989; Dove 1981, 1983). Maybe it is just a difference in perspective on what constitutes "recent," but in this quickly moving field of development projects and policies a 10–20-year lag seems considerable to me. If, after this time, still only 1.1% of projects in the U.K. featured a local-knowledge component, then the alliance that he foresees may be more difficult to achieve than any of us might wish. The more recent studies that he calls "hybrid," an aspect of the knowledge interface, are promising, but I remain skeptical that we will be successful in forging this alliance just by closing our eyes and wishing for it. I would have been very interested to learn Sillitoe's practical suggestions about how to make this partnership happen. Goodwill and interdisciplinary open-mindedness will not be enough to change this highly bureaucratized system and world of development planning, implementation, and evaluation unless accompanied by institutional and policy change. This can occur, as I think the history of women-in-development studies illustrates. It took a great deal of time, effort, and persistence, but the level of awareness of women's issues and actual planning on behalf of women have increased dramatically over the past 20 years. It might be interesting to see if there are any practical lessons to be learned or any parallel political processes at work; there are certainly some good retrospectives about the changing character of this field over time (see, e.g., Tinker 1990) and how this history is linked with changes in academic priorities.

Sillitoe argues that "there is a need to demonstrate that the extra resources and time expended on anthropologically informed research are worth it." I am not very optimistic that this will be possible. Anthropological work of the kind he proposes will never be time efficient (it usually does come quite cheap in terms of financial efficiency) and will always move at a more deliberate, cautionary-tale-telling pace than the development industry would like. This does not mean that we should not persist and forge these alliances whenever possible. It is just not clear to me how often or easily this will occur.

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This is a most welcome synthesis of the role that indigenous knowledge plays in facilitating communications between client groups and development professionals that foster participatory decision making and sustainable approaches to development. After 25 years of work for a paradigm shift in the development arena from the transfer-of-technology approach to a bottom-up participatory approach, it is gratifying that a growing number of multilateral development agencies (e.g., the World Bank and United Nations agencies such as ILO, FAO, UNEP, UNDP, and UNESCO) and bilateral agencies (e.g., CIDA, USAID, and the U.K. Department for International Development) are recognizing that working with and through existing knowledge systems and organizational structures can make projects more cost-effective and sustainable.

The use of the term "indigenous" began with Robert Chambers's group at the Institute of Development Studies, University of Sussex, in 1979. A special issue of the *IDS Bulletin* featured the term "indigenous technical knowledge," and it was followed by the publication of *Indigenous Knowledge Systems and Development* (Brokensha, Warren, and Werner 1980). Most of the contributors to these two publications were anthropologists and geographers. Some of them had had in-depth cross-cultural and linguistic experience in voluntary service organizations such as the Peace Corps that had led to a disillusionment with the top-down development practices common in the 1960s and 1970s. Numerous persons changed disciplines and entered the field of anthropology (see Schwimmer and Warren 1993) with an emphasis on applied and development anthropology.

As Sillitoe notes, the reaction by development professionals until recently has been one of disdain for indigenous knowledge. But somehow the idea of indigenous knowledge has captured the imagination of persons in numerous academic disciplines and spawned an enormous growth of case studies of community-based knowledge systems and the use of them in development projects. With the publication of the first volume in the *Intermediate Technology Studies in Indigenous Knowledge and Development* (Warren, Slikkerveer, and Brokensha 1995) there were several dramatic changes. The disciplines represented had expanded to more than 20, ranging from agronomy to veterinary science, from entomology to plant pathology, from forestry to range management. Although Sillitoe worries that persons in other disciplines are "stealing our disciplinary clothes," many of us see this as advantageous in that it encourages important cross-disciplinary communications fully in line with the role that indigenous knowledge plays in facilitating communications between client groups and development professionals. Another important shift in

the 1995 book is the contributions from numerous multilateral and bilateral development agencies. The third sign of important growth is the inclusion of case studies reflecting not only indigenous knowledge but indigenous decision-making, indigenous organizations, and indigenous approaches to creativity in terms of innovativeness and experimentation. The London book series, now numbering seven volumes, has additional books that deal with these areas in depth (see Blunt and Warren 1996, Prain, Fujisaka, and Warren 1998, Innis 1997). It is anticipated that the cross-disciplinary investigation of indigenous knowledge will increase dramatically with the availability of user-friendly manuals and guides, one still in the testing draft funded by the Canadian International Development Agency (Centre for Traditional Knowledge 1997) and one produced by the Regional Program for the Promotion of Indigenous Knowledge in Asia (IIRR 1996).

We now have an improved understanding of variability within knowledge systems as reflected by gender, age, and occupational roles. There are three types of knowledge for any domain, basic core knowledge possessed by virtually all members of a community that provides the basis for communication on a given topic, shared knowledge that expands on the core knowledge and allows persons occupying related occupational niches to communicate in more specialized ways (e.g., the blacksmith who makes hoe blades for farmers must have more knowledge of soil types in common with the farmers than the goldsmith might require), and specialized knowledge within an occupational niche that most others in the community do not require.

The argument that recorded knowledge systems represent a "sterile and undynamic" database reflects a double standard, with knowledge generated through the global knowledge systems being recorded and placed in libraries and archives while indigenous knowledge systems are not to be removed from their cultural context. All knowledge systems are dynamic and reflect changing circumstances for any given community. McCorkle's study in Niger identified numerous exciting indigenous agricultural experiments, among them the control of the *Striga* weed, making that discovery available to the farmers in Malawi struggling with the same weed. The scientific basis for intercropping has now been established by studies conducted by Innis (1997), whereas the sustainability of high-external-input agriculture in the United States is now in considerable doubt (Warren 1994). Other recent studies recognize the contributions of various communities to the development of biodiversity (Warren and Pinkston 1997), holistic medicine (Warren, Egunjobi, and Wahab 1997), extension (Rajasekaran 1991), biotechnology (Warren 1996, Bunders, Haverkort, and Hiemstra 1996), and education (Warren, Egunjobi, and Wahab 1996). Berlin (1992) has provided an enormous contribution to our understanding of indigenous knowledge systems and how they compare with the global counterpart system. The results of his comparative study indicate far more

uniformity among the systems than had ever been anticipated.

In order to address the issue of intellectual property rights, the Center for Indigenous Knowledge for Agriculture and Rural Development (CIKARD) has been closely involved with a growing global network of indigenous-knowledge resource centers, now numbering 33 (with 20 more in the process of being established), that are operated primarily by nationals. These centers provide the mechanism for protecting indigenous knowledge when that is in the best interest of the community of discovery and the country. They also are expanding their own efforts to introduce case studies of indigenous knowledge from their own countries into educational curricula that still reflect the colonial era, when less attention was given to indigenous knowledge. In Nigeria, for example, there are now 4 indigenous-knowledge resource centers and 4 institutions with indigenous-knowledge study groups. They are involved in recording knowledge systems that are now recognized as important national resources. Students and faculty involved in recording these systems have discovered some complex and sophisticated knowledge that is truly a contribution to global knowledge. They also realize that communities recognize both strengths and weaknesses in their own systems, the weaknesses being reflected in indigenous experimentation that can lead to improving the system.

The home pages for CIKARD (<http://www.iitap.iastate.edu/cikard/cikard.html>) and CIRAN (<http://www.nufficcs.nl/ciran/ikdm> and <http://www.nufficcs.nl/ciran/ik-pages>) now make available globally to anyone with access to the Internet all of the back issues of the *Indigenous Knowledge and Development Monitor*, French and Spanish translations of key indigenous-knowledge documents formerly available only in English, information on the global network of indigenous-knowledge centers, keyword access to citations and abstracts for 5,000+ documents housed in the CIKARD Library, and draft teaching modules based on case studies at CIKARD that reflect the contributions of ethnic and minority groups to global knowledge. Currently more than a third of the 33 centers are linked by e-mail, and a major effort is under way to add the rest.

Sillitoe has made an important contribution to applied anthropology by explicating the role of indigenous knowledge and development anthropology in sustainable approaches to development.

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The widespread failure of the centralized or top-down approach to development in many less-developed countries has recently led to a focus on the bottom-up participatory approach. It is also now generally agreed that thorough understanding and incorporation of indige-

nous knowledge and practices central to local ecological and social systems is essential if we are to achieve sustainable development. This linking of local people's understanding and practices with scientific knowledge is the more important in poor and overpopulated societies fully dependent on natural resources such as Bangladesh. The shortfall in achieving the goals of many thousands of government, nongovernment, and donor-funded projects aiming at poverty alleviation and agricultural development has been ascribed to the lack of participation of the target populations or beneficiary stakeholders. The participatory development advocated by many social and natural scientists, including anthropologists, as a viable alternative approach has been found difficult to operationalise at the grassroots level. While farmers, the majority of whom are landless or smallholders, poor and illiterate, have their own perception of their problems and appropriate solutions grounded in their indigenous knowledge and many of these are quite compatible with science and are followed to good effect, others are based on misconceptions or result from distorted imitations of modern practices. In order to participate more effectively in the development process, people badly need an understanding of their problems in the light of scientific knowledge. There is a need for a fresh approach—a search for the best strategy for achieving viable participation by combining scientific and indigenous knowledge. This article by Sillitoe has effectively illuminated many aspects of this complicated approach. It is a timely contribution to this important debate.

In Bangladesh, anthropology is a fairly new subject, and the participatory approach has only recently been tried in project planning and implementation, but it offers exciting new opportunities. The country's village-based agricultural production system is dependent on local resources and even 50 years ago was based on indigenous knowledge. During the Green Revolution of the 1960s, the indigenous system was ignored as unscientific and unproductive, and farmers were pressured to replace it with so-called modern methods. In many ecologically fragile areas, the abandonment of traditional natural-resource management and agricultural production practices resulted in widespread environmental degradation. For example, the introduction of intensive agriculture and paddy monocropping to the high lands of the Barind Tract watershed of north-western Bangladesh has resulted in topsoil loss and siltation of adjacent water bodies (both rivers and perennial marshes) and adversely affected the sustainability of agricultural production across the watershed. The indigenous knowledge and traditional practices of the local people had been able to exploit the resource base sustainably for many centuries previously. The Barind people, who had traditionally managed the land less intensively (by adopting shallow tillage, one annual crop, regular fallow, diverse cover), were forced to give way and follow the advice of others from different ecological regions who wished to see the land exploited more intensively with greater immediate short-term gains. But the ap-

proach was not sustainable. It has proved to be disastrous for soil fertility, water availability, and agricultural production as well as biodiversity. The Barind experience illustrates how employing nonparticipatory methods not only erodes indigenous knowledge but also results in the loss of local crop varieties and landraces, adversely affecting plant diversity (see Hamid and Hunt 1987, Zuberi and Rahman 1994). The local people, previously well adapted to their environment, find themselves ill-adapted to their own habitat, as their indigenous knowledge has been decreed no longer useful. The once wise old farmers with experience of different soil types, appropriate sites for particular crops, and treatments for various diseases have been marginalised with the imposition of modern methods. Young people no longer follow the experienced farmers to the fields to learn nature's lessons regarding resource management, which traditionally equipped village farmers for life.

The use of indigenous knowledge and local participation require a full understanding of the local system. Our efforts to understand local people's perceptions in the floodplains of Bangladesh have brought to light many interesting problems. The natural and social scientists' attempts to adopt participatory methods have indicated a lack of clear perceptions of the methods. The peasant farmers themselves often showed off by presenting modernised versions of their knowledge, many were unwilling to engage in research without direct return, some offered partial or made-up information, and so on. All this made indigenous knowledge very difficult to access, and its interpretation, understanding, and adoption will certainly prove even more difficult. Such practical experience strongly indicates the need for collaboration of anthropologists and training in this field; the involvement of local research assistants helped us a lot.

In recent years, all large development projects have been required to have environmental impact assessments before they can obtain government permission to proceed. Many of these report no or very little expected negative impact on the natural-resource base or on the livelihood of local people, whereas the reverse invariably proves to be the case. The nonparticipatory approach adopted in development has been disastrous. Without local people's input it is difficult to see how one can fully assess the impact of interventions on their lives; without some understanding of their ways it is difficult to understand how projects can possibly improve their livelihoods. Anthropologists, natural scientists, and development workers should cooperate, as Sillitoe argues, to bring this about without further delay.

Reply

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I thank those who have found the time to reflect on my paper. Their remarks confirm my conviction that the

indigenous-knowledge revolution is important to anthropology. I continue to think of it as a revolution not only because it is part of an important shift in development practice (one which admittedly has been gathering momentum for two or more decades) but also because it augurs profound changes in anthropology with the century's end as informants become partners and their communities collaborating user-groups. The last revolution occurred at the beginning of the century when scholars discovered fieldwork.

The problem of terminology is an intractable one. I have used "indigenous knowledge," a term in vogue in development discourse, but, as several commentators point out, it may be a distortion to counterpose global scientific knowledge with indigenous knowledge when in many communities today persons have both at once and when the content and context of indigenous knowledge are subject to change with globalisation.

Despite globalisation and the fact that identical intellectual capabilities structure all human knowledge, different cultures continue to inculcate persons with different understandings of the world. If we cannot agree on this, then anthropology has indeed been an act of postmodern imagination. It follows from this that the us-and-them dichotomy is inescapable in some measure, and to argue otherwise because of well-intentioned feelings of liberal guilt or whatever is dangerous obscurantism. But difference does not inevitably imply superiority/inferiority, and we are talking about a continuum of relations rather than two separate poles. I emphatically reject the suggestion that "they" are passive and ignorant. The existence of differences, however defined, creates the potential for inequality, and, as many commentators point out, this takes us into a political minefield. Development assumes that the technologically (not morally or culturally) superior West has something to offer the poverty-stricken Rest and that most human beings wish at least to have enough to eat and be healthy. But these others understandably want any development on their own terms, and anthropology should try to facilitate this. How we are to pick our way around the mines without being blown to pieces is an issue in urgent need of debate. What is the status of anthropological research, and how can we ensure that it is not just the appropriation of others' knowledge? If we all have a partial understanding of the world, how can we promote a partnership that generates the synergy that may flow from a combination of perspectives—scientific and folk, global and local? No one stakeholder with only some relevant knowledge and a single set of priorities can guide the process. It is this that prevents local communities alone from taking the helm. The relations of power and domination extend from top to bottom, from international agencies and national governments to local communities and non-governmental organisations. Development is a contested domain, with many stakeholders trying to promote different interests and agendas (Grillo and Stirrat 1997). Although we need to be acutely aware of these interests and agendas, we should bear in mind the limits of our disciplinary competence. We are anthropologists, not politi-

cians, management consultants, or policy makers. We need to define our position so as to avoid the charge of unwarranted interference in the lives of others. We are, I suggest, knowledge brokers. It may be that sometimes we should decide that brokering is too dangerous, rendering local people vulnerable to the unscrupulous (this applies to any anthropological research). This is to promote mutual ignorance, which goes against the anthropological grain. It is often the case, fortunately, that development interventions are well-intentioned and anthropological brokering can further their beneficial effects. By what criteria are we to decide?

Another stance is that some knowledge is better than nothing and it is up to politicians to sort out the power plays. To call on personal experience to illustrate the point, I recently found myself on secondment to the National Research Institute in Papua New Guinea, working on forestry issues. While disconcerted by the country's alarming levels of political corruption and incompetence, which are promoting civil disobedience and lawlessness, I thought that contributing to awareness of community attitudes to logging and conservation might usefully inform the sustainable exploitation of forests—even though politicians have been known to collude with timber companies to circumvent procedures intended to protect the forests and they might misuse such knowledge. Was it worth the risk? No knowledge is, after all, ever neutral. We can hardly retreat to the proverbial philosopher's cave and cut ourselves off from the rest of the world; the potential inequities of current globalising trends are not to be overcome that way.

We are perhaps better equipped as a discipline to cope with variations at the local community level. It is not my intention to suggest that differences within communities, however structured (by gender, age, or some other criterion), are unimportant. Indeed, I made a contentious contribution to the discussion of the intellectual implications of such variation some time ago (Sillitoe 1983, Berlin 1992). I do, however, wish to warn against overstating them, presenting an image of indigenous knowledge as extremely fragmented and therefore difficult to compare with other bodies of knowledge. Similarly, I should not wish to give the impression of underestimating the profound environmental understanding that people may encode in myths, ritual, magical beliefs, and social injunctions, the very stuff of anthropological analysis, although I remain sceptical of alternative atomic theories of matter.

Although I observe that other disciplines—economics, geography, and natural sciences among others—are increasingly engaging in innovative ethnographic fieldwork under the indigenous-knowledge banner, what I am advocating is not exclusiveness but an anthropologically informed engagement. We should, I agree, welcome all those who wish to further this worthwhile work. The enthusiasm which some of them show for indigenous knowledge underlines the point that some scientists are keen to promote anthropological research. But others I know are sceptical and are waiting for us to fail so that they can move back in un-

hindered to develop the technological fixes that for them characterise the development endeavour. I think that the greater the anthropological input, working together with all other interested parties, the less likely this is to occur, for we have already been there. In this regard I argue that one of the urgent tasks facing us is to develop methodologies that promote effective interdisciplinary collaboration, which by default will include local people's helping to establish research priorities and agendas. While it is true that persons from several disciplines have been working on development projects for decades—witness, for example, the integrated rural development and farming systems research programmes—this has largely been a multidisciplinary effort. This is not pedantry; we have a long way to go before we reach the point where different disciplines inform one another's efforts instead of running along in parallel. We have to explore to what extent this is even possible without vitiating the understanding that each discipline brings to problems. Our current disciplinary structuring of knowledge has after all served us well, judging from technological advances (how many readers of this journal do not benefit from airplanes, computers, modern medicine, etc.?).

Anthropology is well placed, with its holistic perspective, its all-encompassing view of culture, to advance interdisciplinary work. Indigenous knowledge is by definition interdisciplinary; local people think of and manage their natural environment as a whole system. Another issue here is assessing the extent to which the cultural embeddedness of knowledge creates meaning and at what level it may be taken up without becoming unacceptably distorted. Is cross-cultural interdisciplinarity realistic? At a time when many of us feel that we are suffering from chronic information overload and are finding it increasingly difficult to handle the flood of words in the narrow specialisms in which we build our careers, how feasible is this interdisciplinarity? Who has the cerebral capacity and the time? To what extent might the new information technology make the task more manageable? These are some of the methodological challenges that flow from an engagement with indigenous knowledge in development.

The battle to include local people's knowledge and practices more prominently in development has largely been won, but many battles remain before the revolution is secure. We have to evolve methodologies that will interface effectively with development interventions and demonstrate to the sceptical what we know and believe. *Vive la voix indigène!*

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